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TAYLOR INSTITUTION

BEQUEATHED
TO THE UNIVERSITY
BY
ROBERT FINCH, M. A.
OF BALLIOL COLLEGE.

THE
ELEMENTS OF LOGIC.
IN FOUR BOOKS.

BOOK I.

Of the Original of our Ideas, their various Diviſions, and the Manner in which they contribute to the Increaſe of Knowledge; with a Philoſophical Account of the Riſe, Progreſs, and Nature of Human Language.

BOOK II.

Of the Grounds of Human Judgment, the Doctrine of Propoſitions, their Uſe in Reaſoning, and Diviſion into Self-evident and Demonſtrable.

BOOK III.

Of Reaſoning and Demonſtration, with their Application to the Inveſtigation of Knowledge, and the common Affairs of Life.

BOOK IV.

Of the Methods of Invention and Science, where the ſeveral Degrees of Evidence are examined, the Notion of Certainty is fixed and ſtated, and the Parts of Knowledge in which it may be attained, demonſtrated at large.

DESIGNED PARTICULARLY FOR YOUNG GENTLEMEN
AT THE UNIVERSITY,

*And to prepare the Way to the Study of Philoſophy
and the Mathematics.*

BY WILLIAM DUNCAN,
Profeſſor of Philoſophy in the Mariſhal College of Aberdeen.

Doctrina ſed Vim promovet inſitam;
Rectique cultus Pectora roborant. HOR.

THE NINTH EDITION.

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(By Aſſignment from the Executors of the late J. Dodſley)
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1800.

TO

THE RIGHT HONOURABLE

STEPHEN POYNTZ, *Eſq*.

SIR,

IF I take this opportunity of publiſhing to the world the eſteem I have for a character to which learning is ſo greatly indebted, I hope you will not think yourſelf injured by ſuch a declaration from a man that honours you, and who looks upon the liberty of putting the following Work under your patronage, as one of the happy incidents of his life.

From the firſt moment I formed the deſign of it, I had it in my thoughts to addreſs it to you; and indeed what could be more natural, than that I ſhould be ambitious of inſcribing a treatiſe upon the elements of philoſophy, to one who has ſo eminently diſtinguiſhed himſelf by his extenſive knowledge in that, as well as all the other branches of human learning?

Your great abilities in every kind, have deſervedly recommended you to the notice of your king and country, and occaſioned your being courted and importuned to accept of thoſe high offices of ſtate which others purſue with ſo much eagerneſs, and find it often difficult to obtain, by all the arts and endeavours of ambition. Nor have your talents been confined to the view of your own country alone:—foreign nations have ſeen and admired you, and ſtill ſpeak with the greateſt applauſes of your wiſe and able conduct, when it was your province to act as a *Britiſh* miniſter abroad.

But the qualities of a great ſtateſman are not thoſe alone by which you have rendered yourſelf illuſtrious. The virtues of private life no leſs actuate and adorn your whole behaviour, and add a new dignity to the high ſtation to which your merit has raiſed you. Affability, complacency of manners, and, above all, an extenſive humanity and benevolence, which takes pleaſure in doing good, are diſtinguiſhing parts of your character, and have contributed no leſs than your other extraordinary endowments, to that univerſal acknowledgment which is paid you by your country.

That you may long live to be an ornament and bleſſing to the nation, and to enjoy the pleaſure which ariſes from a conſciouſneſs of the eſteem and approbation of all good men, is the ſincere and hearty prayer of,

SIR,

Your much obliged
and moſt obedient
humble Servant,

W. Duncan.

THE

ELEMENTS OF LOGIC.

INTRODUCTION.

Importance of the knowledge of ourſelves.

I. Of all the human ſciences, that concerning man is certainly the moſt worthy of man, and the moſt neceſſary part of knowledge. We find ourſelves in this world ſurrounded with a variety of objects; we have powers and faculties fitted to deal with them, and are happy or miſerable in proportion as we know how to frame a right judgment of things, and ſhape our actions agreeably to the circumſtances in which we are placed. No ſtudy therefore is more important han that which introduces us to the knowledge of ourſelves. Hereby we become acquainted with the extent and capacity of the human mind; and learning to diſtinguiſh what objects it is ſuited to, and in what manner it muſt proceed, in order to compaſs its ends, we arrive by degrees at that juſtneſs and truth of underſtanding, which is the great perfection of a rational being.

Different gradations of perfection in things.

II. If we look attentively into things, and ſurvey them in their full extent, we ſee them riſing one above another, in various degrees of eminence. Among the inanimate parts of matter, ſome exhibit nothing worthy our attention; their parts ſeem, as it were, jumbled together by mere chance; nor can we diſcover any beauty, order, or regularity in their compoſition. In others we diſcern the fineſt arrangement, and a certain elegance of contexture, that makes us affix to them a notion of worth and excellence. Thus, metals and precious ſtones are conceived as far ſurpaſſing thoſe unformed maſſes of earth that lie everywhere expoſed to view. If we trace Nature onward, and purſue her through the vegetable and animal kingdoms, we find her ſtill multiplying her perfections, and riſing, by a juſt gradation, from mere mechaniſm to perception, and from perception, in all its various degrees to reaſon and underſtanding.

Uſefulneſs of culture, and particularly of the ſtudy of Logic.

III. But though reaſon be the boundary by which man is diſtinguiſhed from the other creatures that ſurround him, yet we are far from finding it the ſame in all. Nor is this inequality to be wholly aſcribed to the original make of mens minds, or the difference of their natural endowments. For if we look abroad into the ſeveral nations of the world, ſome are over-run with ignorance and barbarity, others flouriſh in learning and the ſciences; and, what is yet more remarkable, the ſame people have, in different ages, been diſtinguiſhed by theſe very oppoſite characters. It is therefore by culture, and a due application of the powers of our minds, that we increaſe their capacity, and carry human reaſon to perfection. Wherever this method is followed, knowledge and ſtrength of underſtanding never fail to enſue; where it is neglected, we remain ignorant of our own worth; and thoſe latent qualities of the ſoul, by which ſhe is fitted to ſurvey this vaſt fabric of the world, to ſcan the Heavens, and ſearch into the cauſes of things, lie buried in darkneſs and obſcurity. No part of knowledge, therefore, yields a fairer proſpect of improvement than that which takes account of the underſtanding, examines its powers and faculties, and ſhews the ways by which it comes to attain its various notions of things. This is properly the deſign of *Logic*, which may be juſtly ſtyled the Hiſtory of the Human Mind, inaſmuch as it traces the progreſs of our knowledge, from our firſt and ſimple perceptions, through all their different combinations, and all thoſe numerous deductions that reſult from variouſly comparing them one with another. It is thus that we are let into the natural frame and contexture of our own minds, and learn in what manner we ought to conduct our thoughts, in order to arrive at truth and avoid error. We ſee how to build one diſcovery upon another, and by preſerving the chain of reaſoning uniform and unbroken, to purſue the relations of things through all their labyrinths and windings, and at length exhibit them to the view of the ſoul, with all the advantages of light and conviction.

Operations of the mind.

IV. But as the underſtanding, in advancing from one part of knowledge to one another, proceeds by a juſt gradation, and exerts various acts, according to the different progreſs it has made, Logicians have been careful to note theſe ſeveral ſteps, and have diſtinguiſhed them in their writings by the name of the Operations of the Mind. Theſe they make four in number, and, agreeably to that, have divided the whole ſyſtem of Logic into four parts, in which theſe acts are ſeverally explained, and the conduct and procedure of the mind, in its different ſtages of improvement, regulated by proper rules and obſervations. Now, in order to judge how far Logicians have followed nature in this diſtinction of the powers of the underſtanding, let us take a ſhort view of the mind, and the manner of its progreſs, according to the experience we have of it in ourſelves, and ſee whither the chain of our own thoughts will without conſtraint lead us.

Perception.

V. Firſt, then, we find ourſelves ſurrounded with a variety of objects, which, acting differently on our ſenſes, convey diſtinct impreſſions into the mind, and thereby rouſe the attention and notice of the underſtanding. By reflecting too on what paſſes within us, we become ſenſible of the operations of our own minds, and attend to them as a new ſet of impreſſions. But in all this there is only bare *conſciouſneſs*. The mind, without proceeding any farther, takes notice of the impreſſions that are made upon it, and views things in order, as they preſent themſelves one after another. This attention of the underſtanding to the objects acting upon it, whereby it becomes ſenſible of the impreſſions they make, is called by Logicians *Perception*; and the notices themſelves, as they exiſt in the mind, and are there treaſured up to be the materials of thinking and knowledge, are diſtinguiſhed by the name of Ideas.

Judgment.

VI. But the mind does not always reſt ſatisfied in the bare view and contemplation of its ideas. It is of a more active and buſy nature, and likes to be aſſembling them together, and comparing them one with another. In this complicated view of things, it readily diſcerns that ſome agree, and others diſagree, and joins or ſeparates them according to this perception. Thus, upon comparing the idea of two added to two, with the idea of four, we at firſt glance perceive their agreement, and thereupon pronounce that two and two are equal to four. Again, that white is not black, that five is leſs than ſeven, are truths to which we immediately aſſent, as ſoon as we compare thoſe ideas together. This is the firſt and ſimpleſt act of the mind in determining the relations of things, when, by a bare attention to its own ideas, comparing any two of them together, it can at once ſee how far they are connected or disjoined. The knowledge thence derived, is called *Intuitive*, as requiring no pains or examination; and the act of the mind aſſembling its ideas together, and joining or disjoining them according to the reſult of its *perceptions*, is what Logicians term *Judgment*.

Reaſoning.

VII. Intuition affords the higheſt degree of certainty; it breaks in with an irreſiſtible light upon the underſtanding, and leaves no room for doubt or heſitation. Could we in all caſes, by thus putting two ideas together, diſcern immediately their agreement or diſagreement, we ſhould be exempt from error, and all its fatal conſequences. But it ſo happens, that many of our ideas are of ſuch a nature, that they cannot be thus examined in concert, or by any immediate application one to another; and then it becomes neceſſary to find out ſome other ideas that will admit of this application, that by means of them we may diſcover the agreement or diſagreement we ſearch for. Thus, the mind wanting to know the agreement or diſagreement in extent between two incloſed fields, which it cannot ſo put together as to diſcover their equality or inequality by an immediate compariſon, caſts about for ſome intermediate idea, which, by being applied firſt to the one, and then to the other, will diſcover the relation it is in queſt of. Accordingly, it aſſumes ſome ſtated length, as a yard, *&c.* and meaſuring the fields, one after the other, comes by that means to the knowledge of the agreement or diſagreement in queſtion. The intervening ideas made uſe of on theſe occaſions, are called *Proofs*; and the exerciſe of the mind in finding them out, and applying them for the diſcovery of the truths it is in ſearch of, is what we term *Reaſoning*. And here let it be obſerved, that the knowledge gained by reaſoning, is a deduction from our intuitive perceptions, and ultimately founded on them. Thus, in the caſe before mentioned, having found by meaſuring, that one of the fields makes threeſcore ſquare yards, and the other only fifty-five, we thence conclude that the firſt field is larger than the ſecond. Here the two firſt perceptions are plainly intuitive, and gained by an immediate application of the meaſure of a yard to the two fields, one after another. The concluſion, though it produces no leſs certain knowledge, yet differs from the others in this, that it is not obtained by an immediate compariſon of the ideas contained in it one with another, but is a deduction from the two preceding judgments, in which the ideas are ſeverally compared with a third, and their relation thereby diſcovered. We ſee, therefore, that reaſoning is a much more complicated act of the mind than ſimple judgment, and neceſſarily preſuppoſes it, as being ultimately founded on the perceptions thence gained, and implying the various compariſons of them one with another. This is the great exerciſe of the human faculties, and the chief inſtrument by which we puſh on our diſcoveries, and enlarge our knowledge. A quickneſs of mind to find out intermediate ideas, and apply them ſkilfully in determining the relations of things, is one of the principal diſtinctions among men, and that which gives ſome ſo remarkable a ſuperiority over others, that we are apt to look upon them as creatures of another ſpecies.

Method.

VIII. Thus far we have traced the progreſs of the mind in thinking, and ſeen it riſing by natural and eaſy ſteps from its firſt and ſimple perceptions, to the exerciſe of its higheſt and moſt diſtinguiſhed faculty. Let us now view it in another light, as enriched with knowledge, and ſtored with a variety of diſcoveries, acquired by a due application of its natural powers. It is obvious to conſider it in theſe circumſtances, as taking a general ſurvey of its whole ſtock of intellectual acquiſitions, diſpoſing them under certain heads and claſſes, and tying them together, according to thoſe connections and dependencies it diſcerns between them. It often happens, in carrying on our enquiries from ſubject to ſubject, that we ſtumble upon unexpected truths, and are encountered by diſcoveries, which our preſent train of thinking gave no proſpect of bringing in our way. A man of clear apprehenſion and diſtinct reaſon, who after due ſearch and examination, has maſtered any part of knowledge, and even made important diſcoveries in it, beyond what he at firſt expected, will not ſuffer his thoughts to lie jumbled together in the ſame confuſed manner as chance offered them; he will be for combining them into a regular ſyſtem, where their mutual dependence may be eaſily traced, and the parts ſeem to grow one out of another. This is that operation of the mind, known by the name of *Diſpoſition* or *Method*, and comes in the laſt in order, according to the diviſion of the Logicians, as preſuppoſing ſome tolerable meaſure of knowledge, before it can have an opportunity of exerting itſelf in any extenſive degree.

Perception and judgment, terms of a very extenſive ſignification.

IX. We ſee then that this fourfold diſtinction of the powers of the mind in perception, judgment, reaſoning, and diſpoſition, as well as the order in which they are placed, have a real foundation in nature, and ariſe from the method and procedure of our own thoughts. It is true, there are many other actions and modifications of the underſtanding, beſides thoſe above-mentioned, as believing, doubting, aſſenting, &c. but theſe are all implied in the act of reaſoning, in the like manner as comprehending, abſtracting, remembering, may be referred to the firſt operation of the mind, or perception. This will appear more fully in the ſequel, when we come to handle the ſeveral parts of Logic ſeparately: at preſent we ſhall content ourſelves with this general account of things; only it ſeems neceſſary to obſerve, that *perception* and *judgment*, in the propriety of the *Engliſh* tongue, have a much more extenſive ſignification than Logicians commonly allow them. We not only perceive the ideas in our own minds, but we are ſaid alſo to perceive their agreement or diſagreement; and hence ariſe the common phraſes of intuitive perceptions, perceptions of truth, and of the juſtneſs of arguments or proofs; where it is manifeſt that the word is applied not only to our judgments, but alſo to our reaſonings. In a word, whatever comes under the view of the mind, ſo as to be diſtinctly repreſented and taken notice of, whether an idea, propoſition, chain of reaſoning, or the order and connection of things, is thereby rendered an object of perception, and gives employment to this firſt and moſt ſimple of our faculties. In like manner, the word *judgment* is ſeldom in common diſcourſe confined to obvious and ſelf-evident truths: it rather ſignifies thoſe conjectures and gueſſes that we form, in caſes which admit not of undoubted certainty, and where we are left to determine, by comparing the various probabilities of things. Thus, a man of ſagacity and penetration, who ſees far into the humours and paſſions of mankind, and ſeldom miſtakes in the opinions he frames of characters and actions, is ſaid to judge well, or think judiciouſly. For theſe reaſons, it might not be improper to change the common names of the two firſt operations of the mind, calling the one *Simple Apprehenſion*, and the other *Intuition*; which two words ſeem better to expreſs their nature, and the manner in which they are converſant about their ſeveral objects. This accuracy of diſtinguiſhing, where there is any the leaſt difference, is in a peculiar manner neceſſary in a treatiſe of Logic, as it is the profeſſed deſign of that ſcience to teach us how to form clear and diſtinct notions of things, and thereby avoid being miſled by their ſimilitude or reſemblance.

Logic divided into four parts. Its uſefulneſs and excellency.

X. Having thus given a general idea of the four operations of the mind, and traced their connection and dependence one upon another, I would next obſerve, that in conſequence of this diviſion of the powers of the underſtanding, *Logic* is alſo divided into four parts, which treat ſeverally of theſe acts, and give rules and directions for their due conduct and regulation. The operations themſelves we have from nature; but how to exert them juſtly, and employ them with advantage in the ſearch of truth, is a knowledge that may be acquired by ſtudy and obſervation. It is certain that we meet with falſe reaſonings as well as juſt. Some men are diſtinguiſhed by an accuracy of thinking, and a happy talent of unravelling and throwing light upon moſt obſcure and intricate ſubjects. Others confound the eaſieſt ſpeculations; their underſtandings ſeem to be formed awry, and they are incapable of either conceiving clearly themſelves, or making their thoughts intelligible to others. If then we ſet ourſelves carefully to obſerve what it is that makes the one ſucceed ſo well, and how the others come to miſcarry, theſe remarks will furniſh us with an art of the higheſt uſe and excellency in the conduct of life. Now this is the preciſe buſineſs of *Logic* —to explain the nature of the human mind, and the proper manner of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into, and teaches us how to diſtinguiſh between truth, and what carries only the appearance of it. By this means we grow acquainted with the nature and force of the underſtanding, ſee what things lie within its reach, where we may attain certainty and demonſtration, and when we muſt be contented with bare probability. Theſe conſiderations ſufficiently evince the uſefulneſs and benefit of this ſcience, which ought to be eſtabliſhed as the foundation and groundwork of all our other knowledge, if we really wiſh to ſucceed in our enquiries. But we ſhall now proceed to treat of its parts ſeparately, according to the diviſion given of them above.

THE
ELEMENTS OF LOGIC.

BOOK I.

OF SIMPLE APPREHENSION, OR PERCEPTION.

CHAP. I.

Of the Original of our Ideas.

Simple apprehenſion and ideas.

I. THE firſt thing we obſerve, when we take a view of what paſſes within us, is, that we are capable of receiving impreſſions from a variety of objects, that diſtinct notices are thereby conveyed into the underſtanding, and that we are conſcious of their being there. This attention of the mind to the objects acting upon it, is what we call *Simple Apprehenſion*, and is in fact the mind itſelf taking a view of things, as repreſented to it by its own conſciouſneſs. It is by this means that we come to be furniſhed with all thoſe *ideas* about which our thoughts are employed; for, being ſenſible of the impreſſions made upon us, and attending to the perceptions they bring, we can renew them again upon occaſion, even when the objects that firſt produced them are removed. Now our *ideas* are nothing elſe but theſe renewed repreſentations of what we have at any time perceived and felt, by means of which things are again brought under the view of the mind, and ſeem to have a kind of exiſtence in it. It is true, we can upon many occaſions combine our ideas variouſly together, and thereby form to ourſelves repreſentations of things that never had an exiſtence in nature, as when we fancy a centaur, or a golden mountain; but it is ſtill certain, that the original ideas, out of which theſe are made, are ſuch as have been conveyed into the mind by ſome former impreſſions. It remains therefore to enquire how we come by our firſt notions and perceptions of things. Whence does the underſtanding derive thoſe original impreſſions and characters, which it can combine in ſo many different ways, and repreſent to itſelf under ſuch infinite varieties? To this I anſwer, that if we attend carefully to what paſſes in our minds, we ſhall obſerve two inlets of knowledge; from whence, as from two fountains, the underſtanding is ſupplied with all the materials of thinking.

All our original ideas derived either from ſenſation

II. Firſt, outward objects, acting upon our ſenſes, rouſe in us a variety of perceptions, according to the different manner in which they affect us. It is thus that we come by the ideas of light and darkneſs, heat and cold, ſweet and bitter, and all thoſe other impreſſions which we term ſenſible qualities. This great ſource and inlet of knowledge is commonly diſtinguiſhed by the name of *Senſation*, as comprehending all the notices conveyed into the mind, by impulſes made upon the organs of ſenſe.

Or reflection.

III. But theſe ideas, numerous as they are, are wholly derived to us from without; there is therefore yet another ſource of impreſſions, ariſing from the mind's attention to its own acts, when, turning inwards upon itſelf, it takes a view of the perceptions that are lodged there, and the various ways in which it employs itſelf about them; for the ideas furniſhed by the ſenſes give the mind an opportunity of exerting its ſeveral powers; and as all our thoughts, under whatever form they appear, are attended with conſciouneſs, hence, the impreſſions they leave, when we come to turn the eye of the ſoul upon them, enrich the underſtanding with a new ſet of perceptions, no leſs diſtinct than thoſe conveyed in by the ſenſes. Thus it is that we get ideas of thinking, doubting, believing, willing, &c. which are the different acts and workings of our minds, repreſented to us by our own conſciouſneſs. This ſecond ſource of ideas is called *Reflection*, and evidently preſuppoſes ſenſation, as the impreſſions it furniſhes are only of the various powers of the underſtanding, employed about perceptions already in the mind.

Riſe and progreſs of human knowledge.

IV. Theſe conſiderations, if we duly attend to them, will give us a clear and diſtinct view of the natural procedure of the human intellect, in its advances to knowledge. We can have no perception of the operations of our own minds, until they are exerted; nor can they be exerted before the underſtanding is furniſhed with ideas about which to employ them: and as theſe ideas, that give the firſt employment to our faculties, are evidently the perceptions of ſenſe, it is plain that all our knowledge muſt begin here. This then is the firſt capacity of the human mind, that it is fitted to receive the impreſſions made upon it by outward objects affecting the ſenſes; which impreſſions thus derived into the underſtanding, and *there lodged* for the view of the ſoul, employ it in various acts of perceiving, remembering, conſidering, &c. all which are attended with an internal feeling and conſciouſneſs. And this leads us to the ſecond ſtep the mind takes in its progreſs towards knowledge, *viz.* that it can by its own conſciouſneſs repreſent to itſelf theſe its ſeveral workings and operations, and thereby furniſh the underſtanding with a new ſtock of ideas. From theſe ſimple beginnings, all our diſcoveries take their riſe: for the mind, thus provided with its original characters and notices of things, has a power of combining, modifying, and examining them in an infinite variety of lights, by which means it is enabled to enlarge the objects of its perception, and finds itſelf poſſeſſed of an inexhauſtible ſtock of materials. It is in the various compariſon of theſe ideas, according to ſuch combinations of them as ſeem beſt to ſuit its ends, that the underſtanding exerts itſelf in the arts of judging and reaſoning, by which the capacious mind of man puſhes on its views of things, adds diſcovery to diſcovery, and often extends its thoughts beyond the utmoſt bounds of the univerſe. Thus we ſee, as it were, at one glance, the whole progreſs of the ſoul, from the very firſt dawnings of perception, till it reaches the perfection of human knowledge; nor ſhall we, among all its vaſt ſtock of diſcoveries, or that infinite variety of conceptions whereof they conſiſt, be able to find one original idea which is not derived from ſenſation or reflection, or one complex idea which is not made up of thoſe original ones.

Diviſion of our ideas into ſimple and complex.

V. Having thus ſhewn how the mind comes to be firſt furniſhed with ideas, we ſhall next proceed to the conſideration of the ideas themſelves, and endeavour to give ſuch an account of them as will beſt ſerve to explain their ſeveral appearances, and the manner in which they are formed. It is evident, from what has been ſaid above, that they all fall naturally under theſe two heads: firſt, thoſe original impreſſions that are conveyed into the mind by ſenſation and reflection, and which exiſt there ſimple, uniform, and without any ſhadow of variety. Secondly, thoſe more complex notions of things that reſult from the various combinations of our ſimple ideas, whether they are conceived to exiſt of themſelves in any particular ſubject, or are united and joined together by the mind enlarging its conceptions of things, and purſuing the ends and purpoſes of knowledge. Theſe two claſſes comprehend our whole ſtock of ideas; and, when conſidered ſeparately in that order wherein they moſt naturally ſeem to offer themſelves to our thoughts, will, I hope, give ſuch a view of the conduct and manner of the mind, as may contribute not a little to introduce us to an acquaintance with ourſelves, and make us ſenſible of the capacity and extent of the human intellect. We proceed therefore to a more particular account of this diviſion of our ideas.

CHAP. II.

Of Simple Ideas.

Simple ideas, what.

I. THE firſt claſs of our ideas are thoſe which I diſtinguiſh by the name of Simple Perception; becauſe they exiſt in the mind under one uniform appearance, without variety or compoſition. For tho' external objects convey at once into the underſtanding many different ideas all united together, and making, as it were, one whole, yet the impreſſions themſelves are evidently diſtinct, and are conceived by the mind, each under a form peculiar to itſelf. Thus the ideas of colour, extenſion, and motion, may be taken in at one and the ſame time from the ſame body; yet theſe three perceptions are as diſtinct in themſelves as if they all proceeded from different objects, or were exhibited to our notice at different times. We are therefore carefully to diſtinguiſh between our ſimple and primitive conceptions, and thoſe different combinations of them which are often ſuggeſted to the mind by ſingle objects acting upon it. The firſt conſtitute our original notices of things, and are not diſtinguiſhable into different ideas, but enter by the ſenſes ſimple and unmixed. They are alſo the materials out of which all the others, how complex and complicated ſoever, are formed; and therefore ought deſervedly to be looked on as the foundation and groundwork of our knowledge.

Simple ideas of ſenſation.

II. Now if we take a ſurvey of theſe ideas, and their ſeveral diviſions and claſſes, we ſhall find them all ſuggeſted to us either by our ſenſes, or the attention of the mind to what paſſes within itſelf. Thus our notices of the different qualities of bodies, are all of the kind we call Simple Ideas, and may be reduced to five general heads, according to the ſeveral organs which are affected by them. Colours, &c. and ſounds, are conveyed in by the eyes and ears; taſtes and ſmells, by the noſe and palate; and heat, cold, and ſolidity, &c. by the touch. Beſides theſe, there are others which make impreſſions on ſeveral of our ſenſes; as extenſion, figure, reſt, and motion, &c. the ideas of which we receive into our minds both by ſeeing and feeling.

Simple ideas of reflection, &c.

III. If we next turn our view upon what paſſes within ourſelves, we ſhall find another ſet of ſimple ideas ariſing from our conſciouſneſs of the acts and operations of our own minds. Perception or thinking, and volition or willing, are what every man experiences in himſelf, and cannot avoid being ſenſible of. I ſhall only obſerve farther, that, beſides all the above-mentioned perceptions, there are others that come into our minds by all the ways of ſenſation and reflection: ſuch are the ideas of pleaſure and pain, power, exiſtence, unity, ſucceſſion, &c. which are derived into our underſtandings both by the action of objects without us, and the conſciouſneſs of what we feel within. It is true, ſome of theſe ideas, as of extenſion and duration, cannot be conceived altogether without parts, nevertheleſs they are juſtly ranked among our ſimple ideas; becauſe their parts being all of the ſame kind, and without the mixture of any other idea, neither of them can be reſolved into two diſtinct and ſeparate conceptions. Thus they ſtill anſwer the definition given above, of being one uniform appearance in the mind, without variety or plurality. But to prevent confounding our ſimple ideas of ſpace and duration with thoſe complex modes of them marked out by the ſeveral meaſures commonly in uſe, as yards, miles, days, years, &c. it may, perhaps, be moſt proper to conſider the leaſt portions of either whereof we can form a clear and diſtinct perception, as the ſimple ideas of that kind out of which all their other modes and combinations are formed. Such an inſtant, or point, may be conceived to be the ſame in reſpect of duration, or ſpace, as unity is in reſpect of number; and will ſerve beſt to ſhew how, by a continued addition or repetition, our more enlarged and complex ideas are made up.

Simple ideas have no admiſſion, but by the proper inlets of nature.

IV. Having thus given a general view of our ſimple ideas, I have ſtill two obſervations to make concerning them. The firſt is, that they are ſuch as can only be conveyed into the mind by the proper channels and avenues provided by nature; inſomuch, that if we are deſtitute of any of thoſe inlets, by which the impreſſions that produce them are wont to be admitted, all the ideas thence ariſing are abſolutely loſt to us; nor can we, by any quickneſs of underſtanding, find a remedy for this want. A man born blind is incapable of the ideas of light and colours; in like manner as one who is deaf can form no notion or conception of ſounds. Hence it appears, that theſe our ſimple ideas are juſt ſuch as nature has furniſhed them, and have no dependence on our will: we can neither deſtroy them or invent any new one, not taken in by the ordinary means of perception. So that we here ſee the utmoſt bounds of human knowledge; which, however mighty and enlarged, cannot exceed the limits of thoſe our ſimple original ideas, and their various combinations.

They furniſh ample materals of knowledge.

V. And this leads me to the ſecond obſervation I propoſed to make, which is, that tho' the mind cannot, in multiplying its conceptions of things, advance one ſtep beyond the materials furniſhed it by ſenſe and conſciouſneſs; yet as it has a power of combining, modifying, and enlarging them, in all the different ways in which they can be put together, it therefore finds itſelf in poſſeſſion of an inexhauſtible treaſure of ideas, ſufficient to employ it to the full extent of all its powers, and furniſh matter for all thoſe various opinions, fancies, and views of things, that make up the ſubject of its thoughts and contemplations. Let us but reflect upon the ſingle idea of unity, or one, and obſerve what a variety of combinations are formed, by continually adding it to itſelf; inſomuch, that the underſtanding finds no ſtop or boundary in its progreſs from number to number. In what an infinity of different lights may extenſion alone be conſidered! What limits can be ſet to that endleſs diverſity of figures, which it is in the power of the imagination to faſhion and repreſent to itſelf! If to theſe we add thoſe numberleſs other combinations that reſult from variouſly compounding and comparing the reſt of our ſimple ideas, we ſhall have little reaſon to complain of being limited to a ſcanty meaſure of knowledge, or that the exerciſe of the human faculties is confined within narrow bounds. But having traced the progreſs of the mind through its original and ſimple ideas until it begins to enlarge its conceptions by uniting and tying them together, it is now time to take a ſurvey of it as thus employed in multiplying its views, that we may ſee by what ſteps it advances from one degree of improvement to another, and how it contrives to manage that infinite ſtock of materials it finds itſelf poſſeſſed of.

The diviſion of complex ideas into thoſe of real exiſtences, and thoſe framed by the mind.

VI. Whoever attentively conſiders his own thoughts, and takes a view of the ſeveral complicated ideas that from time to time offer themſelves to his underſtanding, will readily obſerve that many of them are ſuch as have been derived from without, and ſuggeſted by different objects affecting his perception; others again are formed by the mind itſelf, variouſly combining its ſimple ideas, as ſeems beſt to anſwer thoſe ends and purpoſes it has for the preſent in view. Of the firſt kind are all our ideas of ſubſtances; as of a man, a horſe, a ſtone, gold. Of the ſecond are thoſe arbitrary collections of things which we on many occaſions put together, either for their uſefulneſs in the commerce of life, or to further the purſuit of knowledge: ſuch are our ideas of ſtated lengths, whether of duration or ſpace; as hours, months, miles, leagues, &c. which diviſions are apparently the creatures of the mind, inaſmuch as we often find them different in different countries; a ſure ſign that they are taken from no certain and invariable ſtandard in nature. Many of our ideas of human actions may be alſo referred to this head; as treaſon, inceſt, manſlaughter, &c. which complex notions we do not always derive from an actual view of what theſe words deſcribe, but often from combining the circumſtances of them in our minds, or, which is the moſt uſual way, by hearing their names explained, and the ideas they ſtand for enumerated. Theſe two claſſes comprehend all our complex conceptions, it being impoſſible to conceive any that are not either ſuggeſted to the underſtanding by ſome real exiſtences, or formed by the mind itſelf arbitrarily uniting and compounding its ideas. We ſhall treat of each in order.

CHAP. III.

Of our Ideas of Subſtances.

Ideas of ſubſtances, collections of ſimple ideas, held together by ſome unknown ſupport.

I. THE firſt head of complex ideas, mentioned in the foregoing chapter, is that of *ſubſtances*, which I chooſe to handle before the other, becauſe, as will afterwards appear, the notices derived from this ſource very much help us in forming thoſe arbitrary collections which make up the ſecond diviſion. For in many of them we take our hints from the reality of things, and combine ideas that actually exiſt together, though often with an excluſion of others, as will be explained when we come to treat of abſtract and univerſal notions. It has been already obſerved, that the impreſſions conveyed into the underſtanding from external objects, conſiſt for the moſt part of many different ideas joined together, which all unite to make up one whole. Theſe collections of various ideas, thus co-exiſting in the ſame common ſubject, and held together by ſome unknown bond of union, have been diſtinguiſhed by the name of *ſubſtances:* a word which implies their ſubſiſting of themſelves, without dependence (at leaſt as far as our knowledge reaches) on any other created beings. Such are the ideas we have of gold, iron, water, a man, &c. For if we fix upon any one of theſe, for inſtance gold, the notion under which we repreſent it to ourſelves is that of a body yellow, very weighty, hard, fuſible, malleable, &c.; where we may obſerve, that the ſeveral properties that go to the compoſition of gold, are repreſented to us by clear and evident perceptions; the union too of theſe properties, and their thereby conſtituting a diſtinct ſpecies of body, is clearly apprehended by the mind: but when we would puſh our enquiries farther, and know wherein this union conſiſts, what holds the properties together and gives them their ſelf-ſubſiſtence, here we find ourſelves at a loſs. However, as we cannot conceive qualities, without at the ſame time ſuppoſing ſome ſubject in which they adhere, hence we are naturally led to form the notion of a ſupport, which ſerving as a foundation for the co-exiſtence and union of the different properties of things, gives them that ſeparate and independent exiſtence under which they are repreſented to our conception. This ſupport we denote by the name *ſubſtance*; and as it is an idea applicable to all the different combinations of qualities that exiſt anywhere by themſelves, they are accordingly all called ſubſtances. Thus a houſe, a bowl, a ſtone, &c. having each their diſtinguiſhing properties, and being conceived to exiſt independent one of another, the idea of ſubſtance belongs alike to them all.

The diviſion of modes into eſſential and accidental.

II. In ſubſtances therefore there are two things to be conſidered: Firſt, the general notion of ſelf-ſubſiſtence, which, as I have ſaid, belongs equally to them all; and then the ſeveral qualities, or properties, by which the different kinds and individuals are diſtinguiſhed one from another. Theſe qualities are otherwiſe called modes, and have been diſtinguiſhed into eſſential and accidental, according as they are perceived to be ſeparable or inſeparable from the ſubject to which they belong. Extenſion and ſolidity are eſſential modes of a ſtone, becauſe it cannot be conceived without them; but roundneſs is only an accidental mode, as a ſtone may exiſt under any ſhape or figure, and yet ſtill retain its nature and other properties.

The notion of ſelf-ſubſiſtence inſeparable from ſubſtances.

III. I might run farther into theſe diviſions and ſub-diviſions, in which logicians have been very fertile; but as they tend little to the advancement of real knowledge, and ſerve rather to fill the memory with words and their ſignifications than furniſh clear and diſtinct apprehenſions of things, I ſhall not trouble the reader with them. It is more material to obſerve, that the change of properties in any ſubſtance, though it oftentimes changes the nature of that ſubſtance, that is, its ſpecies or kind; yet it never deſtroys the general notion of ſelf-ſubſiſtence, but leaves that equally clear and applicable as before any ſuch alteration happened. Wood by the application of fire is turned into charcoal; but charcoal, however different from wood, is ſtill a ſubſtance. In like manner, wax may be converted into flame and ſmoke, a human body will moulder into duſt, yet theſe alterations deſtroy not their being or exiſtence; they are ſtill ſubſtances as before, tho' under a different form and appearance. In the ſeveral experiments made by chemiſts, bodies undergo many changes, and put on ſucceſſively a great variety of different ſhapes; and yet, by the ſkill and addreſs of the operator, they are often brought back to their firſt and primitive form. What alteration can we ſuppoſe the fire, or the application of any other body, to make, unleſs on the configuration, texture, or coheſion of the minute parts? When theſe are changed, the body is proportionably changed; when they return to their original ſtate, the body likewiſe puts on its firſt and natural appearance.

Foundation of the different ſpecies of corporeal ſubſtances.

IV. All that is eſſential to matter therefore, is the coheſion of ſolid extended parts; but as theſe parts are capable of innumerable configurations; as their texture may be very various, the internal conſtitution thence ariſing be of conſequence extremely different in different bodies, we may from theſe conſiderations conceive pretty clearly the ſource and foundation of all the different ſpecies of corporeal ſubſtances. Nor is this a notion taken up at random, or one of thoſe chimerical fancies in philoſophy, derived rather from a warmth and livelineſs of imagination, than obſervations drawn from things themſelves. Do we not daily ſee our food, by the changes it undergoes in the different avenues of the body, converted firſt into blood, and thence employed in nouriſhing, building up, and enlarging the ſeveral parts of that wonderful fabric? Rain deſcending from the clouds, and mixing with the mould or earth of a garden, becomes aliment for trees of various kinds, puts on a diverſity of forms, according to the different channels and conveyances through which it paſſes; and at laſt, after innumerable changes and tranſmutations, ſprouts forth in leaves, opens in buds, or is converted into the ſubſtance of the tree itſelf. Can we conceive any greater difference between the component parts of gold and thoſe of ſtone, than between the moiſtened particles of garden-mould and thoſe new forms and figures under which they appear, after they have been thus faſhioned by nature, for the purpoſes of growth and nouriſhment?

Eſſence of ſubſtances nothing but the internal ſtructure and conſtitution.

V. If this be duly attended to, it will not appear wonderful to aſſert, that the variety of material ſubſtances ariſes wholly from the different configuration, ſize, texture, and motion of the minute parts. As theſe happen to be variouſly combined, and knit together under different forms, bodies put on a diverſity of appearances, and convey into the mind by the ſenſes, all thoſe ſeveral impreſſions, by which they are diſtinguiſhed one from another. This internal conſtitution or ſtructure of parts, from which the ſeveral properties that diſtinguiſh any ſubſtance flow, is called the eſſence of that ſubſtance, and is in fact unknown to us, any farther than by the perceivable impreſſions it makes upon the organs of ſenſe. Gold, as has been ſaid, is a body yellow, very weighty, hard, fuſible, malleable, &c. That inward ſtructure and conformation of its minute particles, by which they are ſo cloſely linked together, and from which the properties above mentioned are conceived to flow, is called its eſſence; and the properties themſelves are the perceivable marks that make it known to us, and diſtinguiſh it from all other ſubſtances; for our ſenſes are not acute enough to reach its inward texture and conſtitution. The parts themſelves, as well as their arrangement, lie far beyond the utmoſt penetration of human ſight, even when aſſiſted by microſcopes, and all the other contrivances of art.

Is wholly unknown to us, nor ſerves to diſtinguiſh the ſpecies.

VI. Thus, as to the eſſence or internal conſtitution of gold, we are wholly in the dark; but many of the properties derived from this eſſence, make obvious and diſtinct impreſſions, as the weight, hardneſs, and yellow colour, &c. Theſe properties combined together, and conceived as co-exiſting in the ſame common ſubject, make up our complex idea of gold. The ſame may be ſaid of all the other ſpecies of corporeal ſubſtances; as lead, glaſs, water, &c. our ideas of them being nothing elſe but a collection of the ordinary qualities obſerved in them.

Yet is rightly preſumed to be diſtinct in all the ſeveral kinds.

VII. This however ought to be obſerved, that though the eſſence or inward ſtructure of bodies is altogether unknown to us, yet we rightly judge, that, in all the ſeveral ſpecies, the eſſences are diſtinct. For each ſpecies being a collection of properties, which, taken together, are different from thoſe of every other ſpecies, the conformation of parts, on which theſe properties depend, muſt in like manner be different; and this, as we have ſaid, conſtitutes the eſſence. Iron and glaſs are evidently diſtinct kinds of body; their perceivable qualities have little or nothing common; and therefore the inward ſtructure or conſtitution from which theſe qualities flow, cannot be the ſame in both. But after all, this is the only thing we can with certainty affirm concerning theſe eſſences, which lying ſo wholly in the dark, we ſhall do well to lay them aſide in our reaſonings about things, and ſtick to thoſe more intelligible and ſettled ideas got by joining together their various properties and powers. For thus only is true knowledge promoted, when we argue from known qualities, and not from a ſuppoſed internal conſtitution, which, however real in itſelf, yet comes not within the reach of our faculties, and therefore can never be a ground to us for any diſcoveries or improvements.

By what ſteps we arrive at the notions of immaterial ſubſtances;

VIII. Material ſubſtance, as I have ſaid, includes the idea of ſolid, cohering, extended parts, and is divided into different claſſes, according to the different impreſſions made upon the organs of ſenſe. But, beſides theſe ſenſible ideas received from without, we alſo experience in ourſelves thinking and volition. Theſe actions have no connection with the known properties of body; nay, they ſeem plainly inconſiſtent with ſome of its moſt eſſential qualities. For the mind not only diſcovers no relation between thinking and the motion or arrangement of parts, but it alſo perceives that conſciouſneſs, a ſimple individual act, can never proceed from a compounded ſubſtance, capable of being divided into many. Let us ſuppoſe, for inſtance, a ſyſtem of matter endowed with thought; then either all the parts of which this ſyſtem is compoſed muſt think, which would make it not one but a multitude of diſtinct conſcious beings; or its power of thinking muſt ariſe from the connection of the parts one with another, their motion and diſpoſition, &c. which, all taken together, contribute to the production of thought. But it is evident that the motion of parts, and manner of combining them, can produce nothing but an artful ſtructure, and various modes of motion. All machines of human compoſition, as watches, clocks, &c. however artfully their parts are ſet together, however complicated their ſtructure; though we conceive innumerable different motions, variouſly conjoined, and running one into another with an endleſs diverſity, yet never produce any thing but figure and motion. If a clock tells the hour and minute of the day, it is only by the motion of the different hands, pointing ſucceſſively at the figures marked on the hour-plate for that purpoſe. We never imagine this to be the effect of thought or intelligence; nor conceive it poſſible, by any refinement of ſtructure, ſo to improve the compoſition, as that it ſhall become capable of knowledge and conſciouſneſs. The reaſon is plain: thought is ſomething altogether different from motion and figure; there is not the leaſt connection between them; and therefore it can never be ſuppoſed to reſult from them.

which we otherwiſe call ſpirits.

IX. This then being evident, that intelligence cannot ariſe from an union or combination of unintelligible parts; if we ſuppoſe it to belong to any ſyſtem of matter, we muſt neceſſarily attribute it to all the parts of which that ſyſtem is compoſed; whereby, inſtead of one, we ſhall, as was before obſerved, have a multitude of diſtinct conſcious beings. And becauſe matter, how far ſoever we purſue the minuteneſs of its parts, is ſtill capable of repeated diviſions, even to infinity, it is plain that this abſurdity will follow us through all the ſuppoſitions that make thought inherent in a material ſubſtance. Finding, therefore, conſciouſneſs incompatible with the coheſion of ſolid ſeparable parts, we are neceſſarily led to place it in ſome other ſubſtance of a diſtinct nature and properties, which we call *ſpirit*.

Body and ſpirit diſtinct ſubſtances.

X. And here it is carefully to be obſerved, that the ſeveral ſpecies of *corporeal* ſubſtances, though diſtinguiſhed one from another, and ranked under different names, yet, agreeing in ſome common properties, which, taken together, make up the notion of body, are thence all conceived to partake of this general nature, and to differ only as different modifications of the ſame ſubſtance. Whatever conſiſts of ſolid extended parts, is called Matter; and as all the various ſpecies of body, however diſtinguiſhed from one another by their ſeveral properties, have yet this in common, that they are made up of ſuch ſolid ſeparable parts; hence they fall naturally under the general denomination of material beings, and are not conceived to differ but in their form. Thus gold, antimony, wood, &c. alike partake of the notion of body: they are all equally material ſubſtances, and have no other difference but what ariſes from the different ſtructure and conformation, &c. of parts, as we have ſhewn above. But *ſpirit* is ſomething altogether diſtinct from body; nay, and commonly placed in oppoſition to it; for which reaſon, the beings of this claſs are called *immaterial*: a word that implies not any thing of their nature, but merely denotes its contrariety to that of matter.

There may be many various ſpecies of ſubſtances, beſides thoſe that come within the reach of our faculties.

XI. Body and ſpirit, therefore, differ not as ſpecies of the ſame ſubſtance, but are really diſtinct kinds of ſubſtances, and ſerve as general heads, under which to rank all the particular beings that fall within the compaſs of our knowledge. For we, having no ways of perception but ſenſe and conſciouſneſs, can have no notices of things but as derived from theſe two inlets. By our ſenſes we are informed of the exiſtence of ſolid extended ſubſtances; and reflection tells us that there are thinking conſcious ones. Beyond theſe, our conceptions reach not; and therefore, though there may be many other kinds as different from them as they are from one another, yet having no faculties ſuited to them, they are as remote from our knowledge as light and colours from the apprehenſion of a man born blind. I believe it will hardly be doubted but the ſubſtance of the Creator differs more from that of his creatures than any two created ſubſtances can from one another; and therefore, when we call God a ſpirit, we ought not raſhly to preſume that he is ſo in the ſame ſenſe in which the human ſoul is a ſpirit. The word is indeed uſed by us, to denote in general all thinking intelligent ſubſtances; in which ſenſe God is very fitly called a ſpirit. But it were the height of folly to imagine, becauſe this name is applied as well to the mind of man as the Creator, that therefore they partake of one common nature, and differ only as different modifications of the ſame ſubſtance. This I mention here, to check the preſumption of the human mind, always forward to conclude that every thing comes within its reach, and to deny exiſtence to whatever exceeds the comprehenſion of its ſcanty and limited powers. Beings of a ſuperior claſs, may enjoy many ways of perception unknown to us, from which they receive notices as different from thoſe in our minds as the ideas we apply to ſpirit are from the ideas we apply to body. Solid and thinking beings are, it is true, the only ideas of ſubſtance that we are able to frame; but this is no more an argument againſt the exiſtence of other kinds, than the want of the ideas of light and colours in a blind man would be a good argument againſt the reality or poſſibility of ſuch perceptions.

Difference in the manner of conceiving corporeal and ſpiritual ſubſtances.

XII. Before I diſmiſs this ſubject, it may not be improper to take notice of a remarkable difference as to the manner of our conceiving corporeal and ſpiritual ſubſtances. Thoſe of the firſt kind convey themſelves into the mind, by impreſſions made upon the organs of ſenſe; and as theſe impreſſions are different in different bodies, the ideas they produce muſt of courſe vary in proportion. Thus we get perceptions of diſtinct powers and properties, and range bodies into claſſes according as we find them to agree or diſagree in theſe their obſervable qualities. But it is not ſo in our notion of ſpirits; for having no conception of their powers and operations but by what we feel and experience within ourſelves, we cannot aſcribe to them properties, or ways of knowledge, diſtinct from thoſe ſuggeſted to us by our own conſciouſneſs. And hence it is, that though we readily own there may be various ranks of ſpiritual beings, yet we are not to imagine them divided from one another by any diverſity of powers and operations, but merely by poſſeſſing the ſame powers, &c. in a higher or lower degree. It is not, however, repugnant to reaſon that they ſhould be diſtinguiſhed by their ſeveral properties, in like manner as ſenſible things are by the different qualities obſervable in them; but properties of intellectual natures, diſtinct from thoſe of our own minds, being altogether remote from our conception, cannot ſerve us as a means whereby to diſtinguiſh their different orders. We are therefore neceſſitated to conceive of them in a manner ſuited to our way of knowledge; and when we would rank them into ſpecies, according to the degrees of ſuperiority they are imagined to poſſeſs in the ſcale of being, we aſcribe to them what we find moſt excellent in ourſelves, as knowledge, thinking, foreſight, &c.; and thoſe in different meaſures proportioned to the ſtation peculiar to each rank or ſpecies. But that this is a very imperfect way of diſtinguiſhing the various orders of intellectual beings, will not, I think, need many words to make appear; eſpecially, if we conſider that the manner of communicating our thoughts without the intervention of bodily organs, is a thing to us altogether incomprehenſible, and neceſſarily leads us to ſuppoſe, that they have ways of perception and knowledge which our faculties cannot give us any notice of.

The bounds of knowledge in our preſent ſtate very narrow.

XIII. But I ſhall not purſue theſe reflections farther; what has been ſaid ſufficing to give us ſome little inſight into the extent and capacity of our own minds; to convince us that our preſent ſtate will not admit of a perfect and adequate comprehenſion of things; and to let us ſee that there may be other ways of knowledge, beyond the reach of the faculties we now enjoy; which yet, in ſucceeding ſtages of our exiſtence, we may arrive at, when being freed from the preſent cumberſome load of the body, we ſhall mount up to ſtations of greater eminence, and advance by a perpetual ſeries of approaches towards Him who is the ſtandard of perfection and happineſs.

CHAP. IV.

Of Ideas framed by the Mind.

In framing many complex ideas, the mind is wholly active, and proceeds by a voluntary choice.

I. HITHERTO we have conſidered only ſuch combinations of our ſimple ideas as have a real union in nature, and are ſuggeſted to the mind by things themſelves variouſly affecting our perception: it is now time to take a view of the other claſs of our complex notions; I mean thoſe arbitrary collections of different ideas which we on many occaſions bring together, by that power which we find in ourſelves, of uniting, comparing, and diverſifying our notices of things. In the reception of ſimple ideas, and even in thoſe of ſubſtances, the underſtanding is wholly paſſive, and the perceptions produced correſpond to the impreſſions made upon it. When we ſee a houſe or a tree, they neceſſarily appear each under its proper form; nor is it in our power to receive from theſe objects other ideas than what they are fitted to produce. But in this ſecond claſs of complex conceptions, the mind acts voluntarily and of choice; it combines only ſuch ideas as are ſuppoſed beſt to ſuit its preſent purpoſe; and alters or changes theſe combinations, by inſerting ſome and throwing out others, according as the circumſtances of things require their being viewed in different lights. Now, as this is by far the moſt comprehenſive branch of our ideas, and includes thoſe that moſt frequently occur in the ſearch and purſuit of knowledge, I ſhall endeavour to treat of them in the exacteſt order and method; and for that purpoſe range them under ſeveral heads, according to the different acts of the mind, exerted in framing and putting them together.

Three ſeveral acts exerted by the mind in framing its arbitrary ideas, viz. compoſition,

II. Theſe acts may in the general be all reduced to three. 1. *Compoſition*, when we join many ſimple ideas together, and conſider them as one picture or repreſentation. Such are our ideas of beauty, gratitude, a furlong, &c. And here let it be obſerved, that the mind ſometimes confines itſelf to the various conſiderations of the ſame idea, and, by enlarging it in different degrees, exhibits it under a diverſity of forms. Thus, by adding units together, in diſtinct ſeparate collections, we come by all the ſeveral combinations of numbers; as a dozen, a ſcore, a million. At other times we unite perceptions of different kinds; in which caſe the compoſition is more manifeſt, and the idea itſelf becomes of courſe more complicated. Harmony, for inſtance, is a compound idea, made up of many different ſounds united; all which the muſician muſt have, and put together in his mind, before the ear can be entertained with the actual performance. Now, although the act of the mind is in ſome meaſure exerted in the framing of all our complex notions, yet as many of them include certain limited and particular conſiderations, ariſing from other operations of the mind employed about them, it is neceſſary to take account of theſe acts alſo, if we would conceive clearly the manner in which the ſeveral ſpecies of our compound ideas are formed.

abſtraction,

III. 2. The next operation therefore of the mind, about its ideas, is *abſtraction*, when we ſeparate from any of our conceptions all thoſe circumſtances that render it particular, or the repreſentative of a ſingle determinate object; by which means, inſtead of ſtanding for an individual, it is made to denote a whole rank or claſs of things. Thus upon ſeeing, for inſtance, a ſquare, or circle, we leave out the conſideration of their bulk, and every thing elſe peculiar to them, as they immediately affect our ſight, retaining only the notion of their figure and ſhape. In this manner we get our *general* ideas; for ſuch naked appearances, ſeparated from the circumſtances of time, place, &c. ſerve the mind as ſtandards by which to rank and denominate particular objects. When, therefore, we meet with a figure anſwering to that ſhape and form we had laid up in our underſtandings, it is immediately referred by the mind to this pattern, and called by its name; which, by this means, becomes proper to the whole ſpecies. Thus, a ſquare or circle are *univerſal* terms, common to all figures of that particular ſhape, and alike applicable to them wherever they exiſt; in like manner, as the ideas themſelves are *general*, and repreſentatives of all of the kind.

and compariſon.

IV. 3. The third and laſt act of the mind about its ideas, is the *comparing* them one with another, when we carry our conſideration of things beyond the objects themſelves, and examine their reſpects and correſpondences in reference to other things, which the mind brings into view at the ſame time. It is thus we get all our ideas of *relations*, as of greater, leſs, older, younger, father, ſon, and innumerable others. This threefold view of our ideas, as either compounded of many others put together, or made univerſal by the abſtraction of the mind, or as repreſenting the various relations and habitudes of things, will give us an opportunity of obſerving whatever is moſt curious and uſeful in this fundamental branch of knowledge, and of explaining the manner and procedure of the underſtanding in enlarging its views, and multiplying the objects of perception. That we may therefore conceive of this matter with the greater order and clearneſs, we ſhall make each of theſe ſeveral ideas the ſubject of a diſtinct ſection.

SECT. I.

Of Compound Ideas.

Compound ideas conſidered here merely as combinations of the underſtanding.

I. WE begin therefore with thoſe ideas, which may be properly termed *compound*, as being derived from that power the mind has of uniting many conceptions into one. Though this claſs comprehends, in ſome ſort, all our complex notions, yet they are at preſent conſidered merely as they are combinations of the underſtanding, and with a view to thoſe particular ideas out of which they are framed. Here, as was already obſerved, the mind ſometimes proceeds by enlarging and diverſifying the ſame idea; at other times it brings together ideas of different kinds; and in both ways finds infinite ſcope and variety. But that we may follow the natural procedure of the intellect, and trace it in its advances from ſimple to more complicated acts, we ſhall firſt take a view of it as employed about one and the ſame idea, where perhaps we may meet with ſuch inſtances of addreſs, management, and contrivance, as will appear perfectly aſtoniſhing to one who has never ſet himſelf ſeriouſly to conſider the manner and conduct of his own mind.

Unity the original foundation of all our ideas of number.

II. The moſt obvious and ſimple idea we have, is that of *unity*, or *one*. By adding it to itſelf continually, and retaining the ſeveral collections in our minds, we come by all the different combinations of *numbers*, in which we readily perceive an endleſs diverſity. All theſe ideas are nevertheleſs evidently diſtinct amongthemſelves, the addition of a ſingle unit conſtituting a number as clearly different from that immediately before it, as any two the moſt remote ideas are from one another. But that the underſtanding may not loſe itſelf in the conſideration of thoſe infinite combinations of which unity is capable, it proceeds by regular ſteps; and beginning with the original idea itſelf, purſues it through all its varieties, as they are formed by the repeated continual addition of unit after unit. Thus numbers are made to follow one another in an orderly progreſſion; and the ſeveral ſucceſſive collections are diſtinguiſhed by particular names.

The artful compoſition of the names of numbers, a great help to our conceptions;

III. And here we may take notice of a wonderful artifice, made uſe of by the mind, to facilitate and help it forward in its conceptions. For as the advance from number to number is endleſs, were they all to be diſtinguiſhed by different denominations that had no connection or dependence one upon another, the multitude of them muſt ſoon overcharge the memory, and render it impoſſible for us to go any great way in the progreſs of numbering. For this reaſon it is ſo contrived, that the change of names is reſtrained to a few of the firſt combinations, all the reſt that follow being marked by a repetition of the ſame terms, variouſly compounded and linked together. Thus *thirteen* is ten and three, *fourteen* ten and four, and ſo on to *twenty*, or two tens, when we begin again with one, two, &c. until we advance to *thirty*, or three tens. In this manner the progreſſion continues; and when we arrive at ten tens, to prevent confuſion by a too frequent repetition of the ſame word, that ſum is diſtinguiſhed by the name of an *Hundred*. Again, ten hundred is called a *Thouſand*, at which period the computation begins anew, running through all the former combinations, as ten thouſand, an hundred thouſand, ten hundred thouſand; which laſt collection, for the reaſons mentioned above, has the name of a *Million* appropriated to it. With this million we can begin as before, until it is repeated a million of times; when, if we change the denomination to *Billions*, and advance in the ſame manner through *Trillions*, *Quartillions*, the ſeries may be carried on, without confuſion, to any length we pleaſe.

and one of the principal reaſons that our ideas of numbers are ſo remarkably diſtinct,

IV. This artful combination of names, to mark the gradual increaſe of numbers, is perhaps one of the greateſt refinements of the human underſtanding, and particularly deſerves our admiration for the manner of the compoſition; the ſeveral denominations being ſo contrived, as to diſtinguiſh exactly the ſtages of the progreſſion, and point out their diſtance from the beginning of the ſeries. By this means it happens that our ideas of numbers are, of all others, the moſt accurate and diſtinct; nor does the multitude of units aſſembled together, in the leaſt puzzle or confound the underſtanding. It is indeed amazing, that the mind of man, ſo limited and narrow in its views, ſhould yet here ſeem to ſhake off its natural weakneſs, and diſcover a capacity of managing with eaſe the moſt bulky and formidable collections. If we enquire particularly into the reaſon of this, we ſhall find it wholly owing to the addreſs of the mind, in thus diſtinguiſhing numbers by different names, according to the natural order or progreſſion; for as thoſe names are made to grow one out of another, they may be aptly compared to a chain, all of whoſe parts are linked together by an obvious and viſible connection. Hence it comes to paſs, that when we fix our thoughts upon any number, however great and ſeemingly unmanageable; yet, if it is once determined to a particular name, we find it eaſy to run back through all the ſtages of the progreſſion, even till we arrive at unity itſelf. By this means we ſee, with a ſingle glance of our minds, not only the two extremes of the number under conſideration, but alſo the ſeveral intermediate parts, as they are united to make up the whole.

as they help us to a clear perception of the interjacent parts.

V. Now it is to this clear and accurate view of the interjacent ideas, that we owe our ſo diſtinct perception of the various combinations of numbers. And indeed we may obſerve in the general, that all our ideas of quantity, eſpecially when they grow to be very large, are no otherwiſe aſcertained than by that perception we have of the intervening parts, lying, if I may ſo ſay, between the extremes. When we look at an object conſiderably diſtant from us, if we have a clear view of the interjacent lands and houſes, we are able to determine pretty nearly of its remoteneſs; but if, without ſuch a knowledge of the intervening ſpaces, we ſhould pretend to judge of the diſtance of objects, as when we ſee the ſpire of a ſteeple behind a wall, or beyond a mountain, every one's experience is a proof how liable we are, in theſe caſes, to be deceived. Juſt ſo it is in judging of duration. When we carry back our thoughts to any paſt period of our lives, without conſideration of the number of years or months, we find that our idea of the time elapſed, grows more diſtinct in proportion as we become ſenſible of the intermediate parts of our exiſtence. At firſt we are apt to judge the diſtance extremely ſhort; but when we ſet ourſelves to conſider our ſeveral ſucceſſive thoughts and actions, the idea of the duration grows upon us, and continues to increaſe as the attention of the mind brings new periods of life into view.

Without names, we cannot make any progreſs in numbering.

VI. Hence it will be eaſy to conceive how much the mind is helped forward in its perception of number, by that ready comprehenſion of all the ſeveral ſtages in a progreſſion, which peculiarly belongs to ideas of this claſs. But this, as I have before intimated, we derive from the orderly ſeries and connection of names; inſomuch, that where they ceaſe, the computation of numbers alſo ceaſes with them. We can have no idea of any ſum, without a knowledge of all the terms that go before, according to the natural order in which they follow one another; ſo that he who cannot, in a regular way, count to ninety-nine, will never, while that incapacity continues, be able to form the idea of an hundred; becauſe the chain that holds the parts together, is to him wholly unſerviceable, nor can he repreſent to his mind the ſeveral interjacent combinations, without which it is impoſſible in this caſe to arrive at a diſtinct perception.

The great advantages of addreſs in claſſing our complex conceptions.

VII. I have inſiſted the more largely upon this, not only becauſe it is by number that we meaſure all other things, as duration, extenſion, motion, &c. but alſo becauſe it lets us into the moſt natural view of the conduct and procedure of the underſtanding, and makes us ſenſible of the great art and addreſs that is neceſſary in the claſſing our very complex conceptions. He that can ſo put together the component parts of an idea, as that they ſhall lie obvious to the notice of the mind, and preſent themſelves, when occaſion requires, in a juſt and orderly connection, will not find it very difficult to obtain clear and accurate perceptions in moſt of thoſe ſubjects about which our thoughts are converſant; for the great art of knowledge lies in managing with ſkill the capacity of the intellect, and contriving ſuch helps as, if they ſtrengthen not its natural powers, may yet expoſe them to no unneceſſary fatigue, by entangling and perplexing them with conſiderations remote from the buſineſs in hand. When ideas become very complex, and by the multiplicity of their parts grow too unwieldy to be dealt with in the lump, we muſt eaſe the view of the mind, by taking them to pieces, and ſetting before it the ſeveral portions ſeparately, one after another. By this leiſurely ſurvey we are enabled to take in the whole; and if we can draw it into ſuch an orderly combination as will naturally lead the attention, ſtep by ſtep, in any ſucceeding conſideration of the ſame idea, we ſhall ever have it at command, and with a ſingle glance of thought be able to run over all its parts. I have therefore explained here, at ſome length, the conduct of the mind in numbering; it ſeeming to me the beſt model in this kind, whether we conſider the many advantages derived from ſuch an orderly diſpoſition of our ideas, or the great art and ſkill diſplayed in binding theſe ideas together. This alſo is farther remarkable in the conſideration of number, that from it chiefly we derive the notion we have of *infinity*; it being apparent that, in adding number to number there is no end; the poſſibility of doubling, or increaſing our ſtock in any degree, remaining as obvious to the underſtanding, after a great and continued run of progreſſions, as when it firſt began the computation.

The conſideration of number, of great uſe in aſcertaining our ideas of ſpace and duration.

VIII. If we now turn our thoughts towards *ſpace* and *duration*, here too we ſhall find that we very ſeldom arrive at clear and diſtinct ideas of either, but when we introduce the conſideration of number. The more obvious and limited portions, it is true, eaſily ſlide into the mind, in the natural way of perception; but it was the neceſſity of comparing theſe together that put us upon the contrivance of certain ſtated meaſures, by which preciſely to determine the quantity in each. Thus inches, feet, yards, miles, *&c.* aſcertain our ideas of extenſion; as minutes, hours, days, years, *&c.* meaſure the progreſs of duration. The leſſer parts, as lying moſt open to the notice of the underſtanding, and being more on a level with its powers, are retained with tolerable exactneſs; and the larger portions, when the number of repetitions of which they are made up is known, are thereby alſo reduced into clear and determinate conceptions. A foot and yard are meaſures eaſily comprehended by the mind; nor do we find any difficulty in conceiving a mile, when we conſider it as equal to a certain number of yards. If we are ſtill for increaſing the ſtandard, we may take the ſemidiameter of the earth, and ſuppoſing it equal to 8000 miles, make uſe of it as a meaſure by which to aſcertain the diſtance of the ſun or fixed ſtars. Juſt ſo it is in duration; from hours we riſe to days, months, and years; by theſe repeated, and added together, we meaſure time paſt, or can run forward at pleaſure into futurity, and that without any confuſion or perplexity.

Without it, they are apt to degenerate into a confuſed and irregular heap.

IX. It is however to number alone that we owe this diſtinctneſs of perception, inaſmuch as ſpace and time, conſidered apart from the regular and orderly repetition of miles or years, leave no determinate impreſſions in the mind, by which to know and diſtinguiſh their ſeveral portions. Ideas of either, thus taken in at a venture, are a confuſed and irregular heap, eſpecially where we endeavour to enlarge and magnify our views, and give full play to the powers of the intellect. Something indeed the mind conceives vaſt and mighty, but nothing that is preciſe, accurate, and juſt. But when it begins to conſider theſe ideas as made up of parts, and fixing upon ſuch as are proportioned to its reach, ſets itſelf to examine how often they are repeated to make up the whole, the perceptions of the underſtanding put on a new form, and diſcover their exact bounds and limits.

Infinity an object too mighty for the ſurvey of the human mind.

X. And thus, as before in number, ſo here in extenſion and duration, the mind begins with ſimple and obvious notices, advancing by degrees to more enlarged and intricate conceptions. A day, or a furlong, are of eaſy apprehenſion to the underſtanding; and by their ſubdiviſions into ſtill leſſer ſpaces, exhibit themſelves diſtinctly in all their parts. With theſe variouſly repeated, we travel through ſpace and time; ſo that being able to reduce all our ideas of this claſs, however mighty and enlarged, to the clear and determinate perceptions of number, we can conduct our thoughts without perplexity, and never find ourſelves puzzled but when, preſuming too much on our own ſtrength, we launch into ſpeculations that ſtretch beyond the powers of the human intellect. Number may be compared to a line that, ſetting out from unity, runs on in a continued increaſe of length, without a poſſibility of ever arriving at its ultimate period. So far as we purſue it in our thoughts, and trace its regular advances, ſo far our ideas are accurate and juſt. But when we let looſe our underſtandings after a boundleſs remainder, and would fathom the depth of infinity, we find ourſelves loſt amidſt the greatneſs of our own conceptions. Some notions it is true we have, but ſuch as, exceeding the dimenſions of the mind, lie involved in darkneſs and obſcurity; and being deſtitute of order, method, and connexion, afford no foundation whereon to build any juſt and accurate concluſion.

Never repreſented in its full dimenſions, but by an endleſs and ever growing idea.

XI. And this perhaps may be the reaſon why many modern philoſophers, in their diſcourſes concerning infinity, have run into apparent contradictions; becauſe, encountering with an object too large for the ſurvey of the underſtanding, they found themſelves ſurrounded with inextricable difficulties, which their ſcanty and defective ideas were by no means able to diſſipate or remove. The truth of it is, finite ideas alone are proportioned to a finite underſtanding; and although we are not wholly without a notion of the infinity of number, yet it is not ſuch a one as comprehends and exhauſts its object, or exhibits it to the mind in its full ſize and dimenſions. We only ſee the idea, as capable of an endleſs increaſe, but cannot by any effort of thought take in the whole proſpect; and indeed it is properly that part of it which lies beyond the reach of our perception, and ſtill remains to be taken into the account, to which we give the name of Infinity.

Duration, whether conſidered as paſt or to come, boundleſs; whence our idea of eternity.

XII. This idea of the infinity of number, imperfect as it may ſeem, is nevertheleſs that by which the mind aſcends to the conception of *eternity* and *immenſity*. For when we conſider duration, either as paſt or to come, we find nothing to ſtop the progreſs of our thoughts in the repetition of years, or millions of years: the farther we proceed, the more the idea grows upon us; and when we have wearied ourſelves with vain efforts, we muſt own at laſt that we can no more arrive at the end of duration than at the end of number. It is true, the ſeveral generations of men riſe and diſappear in very quick ſucceſſions; earth itſelf may decay; and thoſe bright luminaries that adorn the firmament of heaven, be extinguiſhed; but the courſe of time will not be thereby diſturbed; that flows uniform and invariable, nor is bounded by the period of their exiſtence. This double view of duration, as having already revolved thro' numberleſs ages, and yet ſtill advancing into futurity in an endleſs progreſſion, properly conſtitutes our idea of *eternity*. We ſpeak indeed of an eternity paſt, and an eternity to come; but both theſe are bounded at one extreme: the former terminates in the preſent moment, and therefore has an end; the latter ſets out from the ſame period, and therefore has a beginning;

but, taken together, they form a line both ways infinitely extended, and which repreſents eternity in its full dimenſions.

The idea of immenſity derived from the conſideration of ſpace ever growing on all ſides of us.

XIII. As, in the conſideration of time, we fix upon the preſent moment, regarding it as the middle point which divides the whole line of duration into two equal parts; ſo, in the conſideration of ſpace, that particular place in which we exiſt is looked upon as a kind of center to the whole expanſion. From thence we let looſe our thoughts on every ſide; above, below, around, and find we can travel on, in the repetition of miles and millions of miles, without ever arriving at the end of the progreſſion. It is not difficult indeed to carry our conceptions to the utmoſt bounds of the univerſe; at leaſt ſo far as it falls within our notice. But then the imagination reſts not here; it ſees immeaſurable ſpaces beyond, capable of receiving new worlds, which it can purſue, as riſing one above another in an endleſs ſucceſſion. This conſideraation of ſpace ever growing on all ſides of us, and yet never to be exhauſted, is that which gives us the idea of *immenſity*; which is in fact nothing elſe but the infinity of number, applied to certain portions of extenſion, as miles, or leagues, &c. and theſe conceived as extended every way around us, in infinite and innumerable right lines.

Compound ideas reſulting from the union of perceptions of different kinds.

XIV. Hitherto we have conſidered the mind as employed about one and the ſame idea, enlarging and diverſifying it in various forms. We have ſeen it riſing from the moſt ſimple and obvious notices to the conception of infinity itſelf; and taken a view of it in all the different ſtages of its improvement. Let us now proceed to the more complicated act of compoſition, when the mind brings ſeveral ideas of different kinds together, and voluntarily combines them into one complex conception. Such, for inſtance, is our idea of a *tune*, as comprehending a variety of notes, with many different modulations of ſound. And here it is to be obſerved, that tho' the complex idea may be excited in us, by hearing the air itſelf ſtruck off upon a proper inſtrument; yet, conſidered originally, it ſtill belongs to this claſs of perceptions, which are diſtinguiſhed as the arbitrary collections of the mind. It was the muſician, or compoſer, that combined the ſeveral notes, and determined the order in which they were to follow one another; nor had the peculiar compoſition of ſounds any real union in nature before they were thus brought together in his mind. Of the ſame nature are moſt of our ideas of human actions; for tho' many of them come to our notice by ſeeing the actions themſelves, or hearing them deſcribed by others, as *diſtilling*, *carving*, *treaſon*, &c. yet it is plain that they muſt have been projected and contrived in the mind of man before they had a real exiſtence.

How the mind is determined in making theſe combinations.

XV. It is here that the underſtanding has the greateſt ſcope, and finds moſt employment for its active powers; nor indeed is it poſſible to ſet any bounds to the ideas of this claſs, the combinations already made being almoſt innumerable, and thoſe yet in the power of the mind affording an endleſs diverſity. It may not however be amiſs to conſider how we conduct ourſelves amidſt ſo great a variety, and by what rules we proceed in making thoſe combinations to which we have affixed particular names, while others, perhaps, no leſs obvious, are neglected. The idea of killing, for inſtance, joined to that of a father, makes a diſtinct ſpecies of action, known by the name of *parricide*. It was doubtleſs as obvious to diſtinguiſh between the killing of an old man and a child, which yet we find is not done; both theſe actions being comprehended under the general name of *murder*. By what views therefore does the mind regulate theſe its combinations? Why is it determined to one collection of ideas rather than another? This cannot be well underſtood, without obſerving, that it is the end of language to communicate our thoughts one to another. Words are the ſigns of our ideas, and ſerve to expreſs the conceptions of the mind. Now it is apparent that ſuch conceptions as are moſt apt to occur in the commerce of life, would be firſt diſtinguiſhed by particular names; the frequent occaſion men have of mentioning theſe among themſelves, rendering this abſolutely neceſſary. But as many of theſe conceptions are collections of different ſimple ideas, hence we are inſenſibly led to ſuch peculiar combinations as are moſt ſerviceable to purpoſes of mutual intercourſe and communication.

Ideas of human actions often formed, before the actions themſelves exiſt.

XVI. Let us ſuppoſe, in the firſt beginnings of ſociety, a company of legiſlators met together, in order to conſult of proper regulations for the government of the community. If they are men of prudence and foreſight, they will naturally obſerve many new occurrences likely to ariſe from this coalition of mankind, and their living together in crowds. Perhaps the age in which they live has not produced an inſtance of one man's killing another; yet from the knowledge of their own frame, and their power of doing hurt, they conceive this as a poſſible caſe, and are willing to provide againſt it. Thus all the ideas that enter into the complex one of *murder*, are brought together and united into one conception, before the action itſelf really exiſts. It is not however thought neceſſary to take into conſideration the age of the perſon, the chief thing in view being to prevent the putting an end to another's life unjuſtly, whether old or young; and therefore the penalty equally affects both caſes. But when they come to conſider the relation in which the perſon killed may ſtand to the murderer, here there appears a manifeſt difference; as it adds to the crime when committed upon a benefactor, and renders it particularly heinous in the caſe of a father. This laſt, therefore, is made to conſtitute a diſtinct ſpecies of action, and has a peculiar puniſhment allotted to it. Thus we ſee how men, according to their different manner of life, and the relations they ſtand in to one another, are naturally led to form ſeveral collections of ſimple ideas, preferably to others, as foreſeeing they may have frequent occaſion to take notice of ſuch preciſe combinations. And becauſe it would be tedious in converſation, every time theſe complex notions occur, to enumerate all the ideas of which they conſiſt, therefore, for the ſake of eaſe and diſpatch, they give them particular names, and thereby render the compoſitions fixed and permanent.

The neceſſity of mutual intercourſe, and mens particular aims in life, a great ſource of complex ideas.

XVII. That it is in this manner we come by our complex ideas, which multiply upon us according as the exigencies of ſociety require, or our purſuits, method of life, and different aims throw occaſions in our way of combining ſuch and ſuch perceptions together, might be eaſily made appear by a ſhort view of the combinations themſelves. Human actions, as occurring moſt frequently, and affording large matter of converſation, debate, and enquiry among men, have been very nicely modified, and diſtinguiſhed into claſſes, according to the ſeveral circumſtances moſt likely to attend them. In like manner the arts and ſciences, in proportion as they are cultivated, leading us into many compound views of things, which otherwiſe would never offer themſelves to the conſideration of the mind; the complex ideas of this ſort, with the names by which they are expreſſed, are, we find, the work of ſuch particular nations where theſe arts and ſciences have chiefly flouriſhed. The *Greeks*, for inſtance, excelled in learning and polite knowledge; hence many of the terms belonging to Rhetoric, Poetry, Philoſophy, Phyſic, *&c.* come originally from their language. Modern fortification has received its greateſt improvements among the *French*; and accordingly the ideas and terms of the art are moſtly derived from writers of that nation. In *Italy*, architecture, muſic, and painting, have been the great exerciſe of the men of genius; it is therefore among them that we find the ſeveral complex notions belonging to theſe parts of ſtudy, as well as the names by which they are expreſſed; nor can we diſcourſe accurately and minutely of the above-mentioned arts, without having recourſe to the language of that climate. And if we deſcend into the particular callings and profeſſions of men, they have all their peculiar collections of ideas, diſtinguiſhed by their ſeveral names, and hardly known but to ſuch as are converſant in that manner of life. Thus *calcination*, *cohobation*, *filtration*, &c. are words ſtanding for complex ideas frequently framed in the minds of chymiſts, and therefore familiar to men of that employment. Yet as theſe, and ſuch like combinations, ſeldom occur in common life, the generality of mankind, we ſee, are in a great meaſure unacquainted with them.

Hence different ſets of them prevail in different countries, and words in one language have none to anſwer them in another.

XVIII. I might purſue theſe ſpeculations farther, and ſhew how the ſeveral faſhions, cuſtoms, and manners of one nation, leading them to form many complex notions which come not ſo naturally in the way of another; different ſets of ideas prevail in different countries, and of courſe have names appropriated to them in one language, to which there are no words that anſwer in another. The procedure and forms of our courts of juſtice have introduced many terms into the *Engliſh* law, which ſtands for collections of ideas framed among no other people. Nor would it be poſſible to render theſe terms by any ſingle words of another language; becauſe where the ideas themſelves prevail not, there are no names provided to expreſs them. In this caſe, therefore, it becomes neceſſary to uſe circumlocutions, and enumerate the ſeveral ideas comprehended in the collection, if we would ſo expreſs ourſelves as to be underſtood in the language of other nations. Nay, even among the ſame people, the change of cuſtoms and opinions frequently brings new ſets of ideas, which of courſe muſt be diſtinguiſhed by particular names; while, at the ſame time, the notions of former ages grow into diſuſe, and the words anſwering them are wholly laid aſide, or employed in a ſignification different from what they had before.

This too the cauſe that languages are in a perpetual flux.

XIX. Thus languages are in a perpetual flux, and by degrees vary ſo much from their original frame as to become unintelligible even to the deſcendants of thoſe who ſpeak them. If we run back into the ages of chivalry in *England*, when tilts and tournaments were in faſhion, how many complex ideas, peculiar to that mode of life, ſhall we find familiar among the men of thoſe times, which are now little known or attended to! On the contrary, the improvements in arts and ſciences that have ſince taken place, have led us into innnmerable views of things to which our forefathers were perfect ſtrangers. But I ſhall not puſh theſe reflections any farther, believing that what has been ſaid will be ſufficient to ſhew the origin and progreſs of our compound ideas, and how the mind is directed in the choice of the combinations it makes. We therefore proceed to the conſideration of abſtract ideas, which make the ſubject of the following ſection.

SECT. II.

Of Abſtract or Univerſal Ideas.

General ideas formed by the abſtraction of the mind.

I. HAVING diſpatched what was neceſſary to be ſaid concerning our compound ideas, conſidered merely as they are combinations of the underſtanding, it is now time to explain how we come by our general notions, which ſerve to repreſent to us a multitude of individuals, and are the ſtandards by which we rank things into ſorts. And this, as we have before intimated, is done by the abſtraction of the mind; which act may be extended to all our ideas, whether ſimple, compound, or of ſubſtances. If, for inſtance, we fix our attention on any particular colour, as ſcarlet, we can leave out the conſideration of all preſent circumſtances, as the ſubject in which it inheres, the time and place of ſeeing it, *&c.* and retaining only the impreſſion itſelf, make it a repreſentative of that quality or appearance, wherever we chance to meet with it. It is thus that abſtract and univerſal ideas are framed; for the mind regarding only the ſcarlet colour, which one day it obſerves perhaps in a piece of cloth, another in a picture, and a third in the rainbow, the appearance is conceived to be the ſame in all theſe objects, and therefore is called by the ſame name.

All the perceptions of the underſtanding particular.

II. But to enter a little more cloſely into this matter, and ſhew that theſe our general conceptions are the mere creatures of the underſtanding, it may not be amiſs to take notice, that all our perceptions of things, whether we derive them from ſenſation or reflection, are of their own nature particular, and repreſent to us ſingle determinate objects. When we ſee a horſe, for inſtance, in the fields, our idea is that of an individual. If we hear a ſound, it is ſomething particular, and different from what we hear at any other time. Every perception of the mind is diſtinct from every other perception; nay, and every idea brought into view by the imagination, as when we frame the image of a lion ſtanding before us, is ſtill ſingular, and repreſents a ſingle object.

The idea of the ſpecies repreſents what is common to different individuals.

III. But when we come to take a view of theſe ſeveral particulars, we readily obſerve among ſome of them a reſemblance; and framing to ourſelves an idea of thoſe things in which any of them are found to agree, we thereby get a general notion, applicable to many individuals. Thus *horſes* are found to reſemble one another in ſhape, voice, and ſtructure of parts. The idea which takes in only the particulars of this reſemblance, excluding what is peculiar to each ſingle animal, becomes of courſe common to all creatures of that kind, and is therefore the repreſentative of a whole claſs of beings. Accordingly the name of that general idea is given to every animal in which that ſhape, voice, and ſtructure is found; for the word *horſe*, implying only theſe particulars, muſt belong to all creatures wherein they exiſt. This is the firſt ſtep or gradation in the forming of abſtract notions, when the mind confines itſelf to the conſideration of individuals, and frames an idea that comprehends ſuch only under it. The rank or claſs of things anſwering to this idea, is called *ſpecies*, in the language of the ſchools: ſo a horſe is a certain *ſpecies* of animals, an oak is a *ſpecies* of trees, and a ſquare is a *ſpecies* of four-ſided figures.

The idea of the genus repreſents what is common to ſeveral ſpecies.

IV. When we have thus learnt to rank individuals into ſorts and claſſes, according to the reſemblance found among them, the mind proceeds next to conſider the ſpecies themſelves, and often in theſe too obſerves a certain likeneſs. Whereupon, throwing out all thoſe particulars wherein the ſeveral ſpecies are found to diſagree, and retaining only ſuch as are common to them all, we thereby frame a ſtill more general idea, comprehending under it a variety of different ſpecies. Thus a ſparrow, a hawk, an eagle, *&c.* are diſtinct ſpecies of birds, which have each their peculiar ſhape and make. They nevertheleſs reſemble one another, in being covered with feathers, and provided with wings that bear them through the air. Out of theſe particulars we form a new idea, including all the common properties of the feathered kind; and appropriating to it the name *bird*, mark by that word another claſs of things, of a higher order than any of the former. This ſuperior diviſion, which extends to ſeveral ſpecies at once, is called in the ſchools the *genus*, and is the ſecond ſtep the mind takes in advancing to univerſal notions.

The mind may advance by manifeſt gradations, in riſing from particular to generals.

V. And thus have I given a ſhort, but I hope intelligible, account of the buſineſs of *genera* and *ſpecies*, about which ſo much has been ſaid in the writings of the logicians. *Species*, in ſtrictneſs and propriety of ſpeech, is ſuch a rank or claſs of things as comprehends under it only individuals; *genus* advances ſtill higher, and takes in a variety of diſtinct ſpecies. It is however to be obſerved, that the mind, in riſing from particulars to generals, does not confine itſelf to one or two gradations, but may carry its views through the whole extent of things, until at length it arrives at an idea embracing the univerſal compaſs of nature. For when we have ranked things into ſorts, and reduced theſe again to the higher order or *genus*, theſe *genera* are ſtill found to reſemble one another in ſome particulars; which being collected into one idea, form a new and more comprehenſive diviſion of things. Thus *bird* is a *genus*, embracing all the varieties of the feathered kind. *Fiſh* implies the ſeveral ſpecies of living creatures which inhabit the waters. *Quadruped* and *inſect* are alſo univerſal ideas, that take in many inferior diſtributions and claſſes. Yet all theſe different orders of being have this in common, that they are provided with organical bodies, fitted for the purpoſes of life and ſpontaneous motion. An idea therefore comprehending only theſe laſt particulars, will equally belong to all the diviſions before enumerated; and the word *animal*, by which it is expreſſed, becomes a general name for the ſeveral creatures endued with life, ſenſe, and ſpontaneous motion. If we are for carrying our views ſtill farther, and framing a yet more univerſal notion, we can caſt our eyes upon both the animate and inanimate parts of nature: wherein we find this mutual correſpondence, that they exiſt, and continue in being. This laſt idea therefore of *being* in general, comprehends under it all the varieties of things, and may be univerſally applied to whatever has either life or exiſtence; ſo that in reſpect of the preſent frame of nature, it is the higheſt and moſt univerſal idea we have.

Whence many intermediate ſteps between the higheſt genus and loweſt ſpecies.

VI. In this ſeries of notions, riſing one above another in the degree of univerſality, that diviſion which comprehends under it ſeveral genera, is called in the ſchools the *higher genus*; which denomination continues until we arrive at the laſt advance f the underſtanding, when being come to the moſt general of all ideas, that admits not of a ſuperior, it is diſtinguiſhed by the name of the *genus generaliſſimum.* In like manner, the ſeveral *genera* comprehended under a higher *genus*, are in reſpect of it conſidered as *ſpecies*; and as theſe two laſt have ſpecies under them, the inferior diviſions are for diſtinction's ſake termed *lower ſpecies.* Thus the progreſſion continues, and when we come to the loweſt ſub-diviſion of all, comprehending only individuals, which as I have before intimated, conſtitutes the proper ſpecies, this the ſchools denominate the *ſpecies ſpecialiſſima.* All that lie between it and the higheſt diſtribution of things, are the intermediate genera and ſpecies which are termed, each in their turn, *genus generalius*, or *ſpecies ſpecialior*, according as we conſider them in the aſcending or deſcending ſcale of our ideas; or, to ſpeak in the language of logicians, according to their aſcent or deſcent *in linea prædicamentali.* I ſhould not have entered ſo far into theſe verbal diſquiſitions, had not the terms here explained been ſuch as frequently occur in the writings of philoſophers; inſomuch that without ſome knowledge of them, we muſt often be at a loſs, in the proſecution of theſe ſtudies. Beſides, it is both curious and uſeful, to ſee the gradual progreſs of the mind, in its advances from particular to general conceptions; to obſerve it ranging its ideas into claſſes, and eſtabliſhing a juſt and regular ſubordination in its views and notices of things. This is the ſhorteſt way to knowledge, and affords the beſt means of preſerving the order and due connection of our thoughts, ſo as to make them ſubſervient to the increaſe of ſcience. For when we ſee how things comprehend, or are comprehended in one another, we are able to diſcover the mutual dependence of all the ſeveral branches of knowledge, which leads us into the true and natural method of conducting our underſtandings in the ſearch of truth.

General ideas the creatures of the underſtanding.

VII. From what has been ſaid, it is evident that general ideas are the creatures and inventions of the underſtanding. Nature, it is true, in the production of things, makes many of them alike; but it is the mind alone that collects the particulars in which they agree into one idea, and ſets it up as a repreſentative of many individuals. And now I think we may venture upon that much agitated queſtion, Where do the genera and ſpecies of things exiſt? To which I anſwer, In the mind. *Univerſality* belongs not to things themſelves, it being apparent that they are all particular in their exiſtence. However, as they often have many properties in common, the underſtanding, by uniting theſe into one conception, obtains a general idea, under which it ranks all the ſeveral objects wherein theſe proprieties are found. So far indeed we muſt allow, that the particular combination of properties which conſtitutes the genus or ſpecies, exiſts in all the individuals referred to that genus or ſpecies; but then it is in conjunction with other properties, by which theſe individuals are diſtinguiſhed from one another. Thus the collection of ſimple ideas, ſignified by the word *bird*, is to be found for inſtance in a *hawk*, or any other ſingle animal to which we apply that general name; but the notion itſelf, abſtracted from all the particulars to which it belongs, has evidently no exiſtence out of the underſtanding. There is not a being in nature that can be called a *bird* in general, or that does not neceſſarily imply, in the very conception of it, ſeveral ſimple ideas, beſides thoſe marked by that word. For the name in this caſe ſignifies no more than an animal covered with feathers, and provided with wings, without regard either to ſhape, bulk, or the particular time and place of its exiſtence. Theſe laſt conſiderations however are inſeparable from the reality of things, and therefore muſt be added to the general idea, before we can conceive any thing conformable to it actually brought into being.

Conſidered apart, they exiſt only in the mind, but in conjunction with other ideas in the individuals comprehended under them.

VIII. Hence we ſee at once what ſort of an exiſtence general natures have. Conſidered apart, and by themſelves, they are wholly the workmanſhip of the underſtanding, and derive their being and reality from it; but viewed in conjunction with other ideas that co-exiſt with them in the ſeveral objects of nature, they are to be found in the individuals to which they refer; and therefore, according to this way of conception, may be ſaid to have an exiſtence in them. Thus ſo long as the ideas anſwering to the words *man* or *tree*, continue general and undetermined, they have no real objects anſwering them in nature; nor can the collection of ſimple ideas, marked by theſe names, while all others are ſuppoſed excluded, exiſt anywhere out of the underſtanding. Nevertheleſs, as all the ſimple ideas included in the general notion of *man*, are to be found in every particular *man*; and all thoſe implied in the notion of a *tree*, in every particular *tree*, hence the general nature of *man* exiſts in every individual *man*, as does the general nature of a *tree* in every individual *tree*.

Difference of ideas conſidered as compound, and as univerſal.

IX. One thing ſtill remains to be obſerved, with regard to theſe our general ideas; that though many of them are evidently combinations of different ſimple ideas, and, according to that way of conſidering them, are included in the firſt diviſion of our complex conceptions, thoſe namely framed by the compoſition of the mind; yet we are carefully to diſtinguiſh between an idea as it is compound, and as it is univerſal. In the firſt caſe, the mind chiefly conſiders the ſeveral ideas that are combined together; or, in other words, all the attributes, qualities, or parts, that are contained in any idea. Thus, the idea of a *bird* includes life, ſenſe, ſpontaneous motion, a covering of feathers, wings, *&c.* none of which can be left out without deſtroying the very nature of the idea, and making it ſomething quite different from what it was before This way of conſidering things according to the number of their parts and properties, is called by Logicians the *comprehenſion* of an idea. But the *univerſality* of our notions implies quite another turn of thinking, in as much as it fixes the regard of the mind upon the ſubjects to which our ideas extend, or the individuals and ſpecies comprehended under them. In this ſenſe, the ideas anſwering to the word *bird*, take in the ſeveral ſpecies of the feathered creation, the *hawk*, the *eagle*, *ſparrow*, *lark*, and innumerable others, to all which it may with equal propriety be applied. And here it is remarkable, that the idea loſes nothing of its force or *comprehenſion*, by being reſtricted to a particular kind. When I ſay the *bird of Jove*, though in this caſe the idea is reſtrained to the *eagle* alone, it ſtill remains as diſtinct, and includes as many ſimple ideas in its compoſition as when before it was extended to all the different tribes of feathered animals.

The comprehenſion and extenſion of our ideas.

X. We ſee therefore that our compound ideas may continue the ſame in reſpect of their attributes, or the number of parts, and yet vary conſiderably in the degree of univerſality. The general idea of *man* is the ſame, whether applied to the whole human race, or thoſe of any particular nation. When I affirm, for inſtance, of mankind in general, that their knowledge falls ſhort of perfection, and afterwards make the like obſervation of the men of the preſent age, in both caſes, the word *man* ſtands for one and the ſame collection of ſimple ideas; but in reſpect of the individuals to which it is applied, there is a great and manifeſt difference. That is, the term *man*, denotes one invariable compound idea; which, notwithſtanding, conſidered as a general notion, may be contracted or enlarged at pleaſure. And as in the former caſe the ſeveral parts of compound idea is called its *comprehenſion*, ſo in the latter, the individuals to which the univerſal idea is applied, is called its *extenſion*. I might add many more obſervations on this ſubject; but chooſe rather to ſtop here, having ſaid enough to explain the difference between compound and abſtract ideas, and ſhew the reaſon of my ranging them under diſtinct heads.

SECT. III.

Of our Ideas of Relations.

Ideas of relations exceeding numerous.

I. I COME now to the third and laſt diviſion of thoſe ideas which I conſider as the creatures and workmanſhip of the underſtanding; ſuch namely as ariſe from the comparing of things one with another; for the mind in its views is not tied to ſingle objects, but can examine their references and reſpects, in regard to others, brought under conſideration at the ſame time: and when it does ſo, and thence derives new notices of things, the ideas thus got are called relations, and make, I am apt to think, the largeſt claſs of all our perceptions. For every ſingle object will admit of almoſt innumerable compariſons with others, and in this ſenſe may become a very plentiful ſource of ideas to the underſtanding. Thus, if we compare one thing with another in reſpect of *bulk*, we get the ideas of *greater*, *leſs*, or *equality*; if, in reſpect of *time*, of *older* and *younger*; and ſo for other relations, which we can purſue at pleaſure almoſt without end; whence it is eaſy to conceive how very extenſive this tribe of our perceptions muſt be.

Men chiefly determined to particular compariſon by the wants and exigencies of life.

II. I ſhall not pretend to trace out theſe ideas particularly, nor indeed ſo much as to enumerate their ſeveral diviſions; it being enough to obſerve, that here, as well as in the other kinds of our complex ideas, we bound ourſelves for the moſt part of ſuch compariſons as the exigencies of ſociety, the wants of life, and the different profeſſions of men, render neceſſary; and are more or leſs accurate in tracing out the relations of things, according to the degree of importance they appear to have in theſe reſpects. The relations of men one to another, ariſing either from the ties of blood, their ſeveral ranks and places in the community, or a mutual intercourſe of good offices, being of great weight and concern in the commerce of life, have in a particular manner engaged our attention, and are therefore very minutely deſcribed. For the ſame reaſon, men have found it neceſſary to determine as exactly as poſſible, the various dependence of things, as their happineſs is nearly connected with this knowledge. When we conſider the objects merely in reſpect of exiſtence, as either giving or receiving it, we come by the ideas of *cauſe and effect:* nor need I mention how much the welfare of mankind depends upon an extenſive view of things as they ſtand connected in this relation; it being evident that the ſeveral ſchemes and purpoſes of life are all conducted upon a previous ſuppoſition, that certain known cauſes will have their uſual regular effects, and ſuch and ſuch actions be attended with ſuch and ſuch conſequences.

Relations of Creator and creature, &c.

III. But there are other relations of this kind, beſides thoſe that regard merely exiſtence; as when we alſo take into the account the additional gifts of a capacity for happineſs, and the means of attaining it; which conſtitutes the relation of *Creator* and *creature*, in the more ſolemn acceptation of theſe words. Again, when we conſider the great Author of our being, not only as the Creator of the univerſe, but alſo as preſerving and holding it together, and preſiding over the preſent frame of things with uncontrouled dominion, he then appears under the notion of a *moral Governor*, to whom we are accountable for our actions, and the uſe we make of thoſe powers and faculties we derive from him. Now, as it is of the higheſt conſequence for men not to be unacquainted with theſe and ſuch like relations, hence we find, that of the wiſeſt nations, and ſuch as beſt underſtood the true application of the powers of the mind, have always made it their chief ſtudy to regulate and aſcertain theſe ideas, and trace them in all their conſequences. And thus we may in ſome meaſure perceive how the mind proceeds in comparing its ideas together, and by what views it is chiefly governed, in framing the complex notions of this claſs, by which it repreſents the various habitudes of things, I ſhall only add upon this ſubject theſe two obſervations:—

Our ideas of relations very clear and diſtinct.

IV. Firſt, that our ideas of relations are for the moſt part very clear and diſtinct; for the comparing of things together being a voluntary act of the mind, we cannot but ſuppoſe that it muſt be acquainted with its own views in the compariſon, and of courſe have a clear conception of the foundation of that relation it ſets itſelf to enquire into. Thus the relation of cauſe and effect, implying only that one thing produces, or is produced by another, which notions are always diſtinctly ſettled in the underſtanding before it goes about to make the compariſon, it is evident that the idea repreſenting this mutual reſpect of objects, will be no leſs clear than are the notions themſelves upon which the relation is founded. And what is ſtill more remarkable of the ideas of this claſs, they ceaſe not to be diſtinct, even where the ſubjects compared are but very imperfectly known. For I can well enough conceive that one thing has produced another, and that therefore they ſtand related as cauſe and effect, though my ideas of the things themſelves may perhaps be very obſcure, and come far ſhort of repreſenting their real nature and properties. I doubt not but it will be readily owned, that our idea of the univerſe, conſidered as comprehending the whole frame of created things, is very inadequate; and I think it is ſtill more apparent, that our notion of the Supreme Being comes not up to the excellence and perfection of his nature. Yet we very well underſtand what is meant by calling God the Author of the world; and though we comprehend not the manner of his producing it, find no difficulty in framing the ideas, the relative words *Creator* and *creature* ſtand for.

Ideas of relations among the moſt important conceptions of the mind.

V. I have yet another obſervation to make upon this ſubject; and it is, that our ideas of relations are among the moſt important conceptions of the underſtanding, and afford the largeſt field for the exercife and improvement of human knowledge. Moſt of our enquiries regard relative ideas, and are ſet on foot with a view to inveſtigate the mutual habitudes of things. The mathematician has taken quantity for his province, and teaches us how to compare magnitudes of different figures and dimenſions, in order to judge with certainty of their relative properties. The philoſopher attaches himſelf to the chain of cauſes and effects, and endeavours to trace out the various dependence of things conſidered in this light. In fine, whither do all our reſearches tend, but, by means of certain known properties and relations, to find out others that ſtand ſomehow connected with them? As for the importance of theſe conceptions, no one can call that in queſtion who reflects, that from our relations to our Creator and one another, ariſe all the duties of morality and religion; and that the correſpondence of the ſeveral objects of nature to the organs of the body and faculties of the mind, is that by which alone we can judge of what will procure us happineſs or miſery. Whence it is evident, that without an exact knowledge of theſe relations, we muſt wander on in life with great uncertainty, and may often plunge into calamities and misfortunes, by thoſe very purſuits, from which we expected nothing but joy and pleaſure.

Recapitulation.

VI. Thus have I gone thro' the ſeveral diviſions of our ideas, which I have endeavoured to repreſent in ſuch a manner as their vaſt extent may moſt eaſily appear, and the conduct of the mind in framing them be diſtinctly apprehended. I might eaſily run into other diſtinctions, by conſidering them as *clear* or *obſcure*, *adequate* or *inadequate*, *true* or *falſe*. But the limits of this tract will not allow my entering more fully into the ſubject, and I think it the leſs needful, becauſe the very names are almoſt ſufficient to convey a notion of theſe ſeveral kinds of ideas into the mind. But as the diviſion explained above ſeems to be of great importance towards ſettling in the underſtanding a juſt view of the progreſs of human knowledge, and the ſteps by which it advances from one degree of improvement to another, I ſhall here run over it again in as few words as poſſible, that the whole proceſs may be ſeen at once. Our ideas are all derived into the underſtanding, either by ſenſation or reflection. This however is obſervable, that one and the ſame object often excites a variety of perceptions at once, which are nevertheleſs readily diſtinguiſhed by the mind, and appear each under a form peculiar to itſelf. Theſe conſtitute our primary and original notices, and are eaſily known from all others, in as much as they are entirely void of plurality, and cannot be divided into two or more different ideas. They are alſo the materials out of which the others are formed, and are therefore, by way of diſtinction, called Simple Ideas. But the mind, though it has no power over theſe, either to faſhion or deſtroy them, can yet combine them in an infinite number of ways; and from their various combinations reſult all our complex ideas, which are of two principal kinds. Firſt, Such as are derived from without, and repreſent thoſe combinations of ſimple ideas that have a real exiſtence in nature. Of this ſort are all our ideas of ſubſtances. Secondly, The conception formed by the mind itſelf, arbitrarily uniting and putting together its ideas; and as this makes by far the largeſt claſs, and comprehends all thoſe ideas which may be properly termed our own, as being the real workmanſhip of the underſtanding, ſo they fall very naturally under three diſtinct heads; for either the mind combines ſeveral ſimple ideas together, in order to form them into one conception, in which the number and quality of the ideas united are principally conſidered (and thus it is we come by all our *compound* notions); or it fixes upon any of its ideas, whether ſimple, compound, or of ſubſtances, and leaving out the circumſtances of time, place, real exiſtence, and whatever renders it particular, conſiders the appearance alone, and makes that a repreſentative of all of the kind; whence our *abſtract* and *univerſal* ideas are derived; or, Laſtly, It compares things one with another, examines their mutual connections, and thereby furniſhes itſelf with a new ſet of notions, known by the name of *relations*; which, as has been already remarked, make by no means the leaſt important claſs of our perceptions. This diviſion of our ideas, as it ſeems to be the moſt natural, and truly to repreſent the manner in which they are introduced into the mind, ſo I believe it will be found to comprehend them in all their varieties. I ſhall therefore now proceed to offer ſome obſervations upon language, as being the great inſtrument by which we are enabled to make our ideas and perceptions known to others.

CHAP. V.

Of Words, conſidered as the Signs of our Ideas.

Words furniſh the means of recording our own thoughts,

I. WE have ſeen how the mind comes to be firſt furniſhed with ideas, and by what methods it contrives to diverſify and enlarge its ſtock; let us now conſider the means of making known our thoughts to others, that we may not only underſtand how knowledge is acquired, but alſo in what manner it may be communicated with the greateſt certainty and advantage; for our ideas, though manifold and various, are nevertheleſs all within our own breaſts, inviſible to others, nor can of themſelves be made appear. But God deſigning us for ſociety, and to have a fellowſhip with thoſe of our kind, has provided us with organs fitted to frame articulate ſounds, and given us alſo a capacity of uſing thoſe ſounds, as ſigns of internal conceptions. Hence ſpring words and languages; for having once pitched upon any ſound to ſtand as the mark of an idea in the mind, cuſtom by degrees eſtabliſhes ſuch a connection between them, that the appearance of the idea in the underſtanding always brings to our remembrance the ſound or name by which it is expreſſed; as in like manner the hearing of the ſound never fails to excite the idea for which it is made to ſtand. And thus it is eaſy to conceive how a man may record his own thoughts, and bring them again into view, in any ſucceeding period of life: for this connection being once ſettled, as the ſame ſounds will always ſerve to excite the ſame ideas, if he can but contrive to regiſter his words in the order and diſpoſition in which the preſent train of his thoughts preſents them to his imagination, it is evident he will be able to recall theſe thoughts at pleaſure, and that too in the very manner of their firſt appearance. Accordingly, we find that the inventions of writing and painting, by enabling us to fix and perpetuate ſuch periſhable things as ſounds, have alſo furniſhed us with the means of giving a kind of permanency to the tranſactions of the mind, inſomuch that they may be in the ſame manner ſubjected to our review as any the other abiding objects of nature.

and of the mutual communication of knowledge from one man to another.

II. But beſides the ability of recording our own thoughts, there is this farther advantage in the uſe of external ſigns, that they enable us to communicate our ſentiments to others, and alſo receive information of what paſſes in their breaſts. For any number of men, having agreed to eſtabliſh the ſame ſounds as ſigns of the ſame ideas, it is apparent that the repetition of theſe ſounds muſt excite the like perceptions in each, and create a perfect correſpondence of thoughts. When, for inſtance, any train of ideas ſucceed one another in any mind, if the names by which I am wont to expreſs them have been annexed by thoſe with whom I converſe to the very ſame ſet of ideas, nothing is more evident than that by repeating thoſe names according to the tenor of my preſent conceptions, I ſhall raiſe in their minds the ſame courſe of thought as has taken poſſeſſion of my own. Hence, by barely attending to what paſſes within themſelves, they will alſo become acquainted with the ideas in my underſtanding, and have them in a manner laid before their view. So that we here clearly perceive how a man may communicate his ſentiments, knowledge, and diſcoveries to others, if the language in which he converſes be extenſive enough to mark all the ideas and tranſactions of his mind. But as this is not always the caſe, and men are often obliged to invent terms of their own to expreſs new views and conceptions of things, it may be aſked, How in theſe circumſtances we can become acquainted with the thoughts of another, when he makes uſe of words to which we have never annexed any ideas, and that of courſe can raiſe no perceptions in our minds? Now, in order to unveil this myſtery, and give ſome little inſight into the foundation, growth, and improvement of language, the following obſervations will, I am apt to think, be found of conſiderable moment.

Simple ideas cannot be conveyed into the mind by words, or a deſcription.

III. Firſt, That no word can be to any man the ſign of an idea, till that idea comes to have a real exiſtence in his mind. For names being only ſo far intelligible as they denote known internal conceptions, where they have none ſuch to anſwer them, there they are plainly ſounds without ſignification, and of courſe convey no inſtruction or knowledge; but no ſooner are the ideas to which they belong raiſed in the underſtanding, than finding it eaſy to connect them with the eſtabliſhed names, we can join in any agreement of this kind made by others, and thereby enjoy the benefit of their diſcoveries. The firſt thing therefore to be conſidered is, how theſe ideas may be conveyed into the mind; that being there, we may learn to connect them with their appropriated ſounds, and ſo become capable of underſtanding others, when they make uſe of theſe ſounds in laying open and communicating their thoughts. Now to comprehend this diſtinctly, it will be neceſſary to call to mind the before-mentioned diviſion of our ideas into ſimple and complex. And firſt, as for our ſimple ideas, it has been already obſerved, that they can find no admiſſion into the mind, but by the two original fountains of knowledge,—ſenſation and reflection. If therefore any of theſe have as yet no being in the underſtanding, it is impoſſible by words or a deſcription to excite them there. A man who had never felt the impreſſion of *heat*, could not be brought to comprehend that ſenſation by any thing we might ſay to explain it. If we would really produce the idea in him, it muſt be by applying the proper object to his ſenſes, and bringing him within the influence of a hot body. When this is done, and experience has taught him the perception to which men have annexed the name *heat*, it then becomes to him the ſign of that idea, and he thenceforth underſtands the meaning of a term, which before all the words in the world would not have been ſufficient to convey into his mind. The caſe is the ſame in reſpect of light and colours. A man born blind, and thereby deprived of the only conveyance for the ideas of this claſs, can never be brought to underſtand the names by which they are expreſſed. The reaſon is plain: they ſtand for ideas that have no exiſtence in his mind; and as the organ appropriated to their reception is wanting, all other contrivances are vain, nor can they by any force of deſcription be raiſed in his imagination. But it is quite otherwiſe in our complex notions. For theſe being no more than certain combinations of ſimple ideas put together in various forms, if the original ideas, out of which theſe collections are made, have already got admiſſion into the underſtanding, and the names ſerving to expreſs them are known, it will be eaſy, by enumerating the ſeveral ideas concerned in the compoſition, and marking the order and manner in which they are united, to raiſe any complex conception in the mind. Thus the idea anſwering to the word *rainbow*, may be readily excited in the imagination of another, who has never ſeen the appearance itſelf, by barely deſcribing the figure, largeneſs, poſition, and order of colours, if we ſuppoſe theſe ſeveral ſimple ideas, with their names, ſufficiently known to him.

The names of complex ideas definable, thoſe of ſimple ideas not.

IV. And this naturally leads me to a ſecond obſervation upon this ſubject, namely, that words ſtanding for complex ideas are all definable, but thoſe by which we denote ſimple ideas are not; for the perceptions of this latter claſs having no other entrance into the mind than by ſenſation or reflection, can only be got by experience from the ſeveral objects of nature, proper to produce thoſe perceptions in us. Words indeed may very well ſerve to remind us of them, if they have already found admiſſion into the underſtanding, and their connection with the eſtabliſhed names is known; but they can never give them their original being and exiſtence there. And hence it is, that when any one aſks the meaning of a word denoting a ſimple idea, we pretend not to explain it to him by a definition, well knowing that to be impoſſible; but ſuppoſing him already acquainted with the idea, and only ignorant of the name by which it is called, we either mention it to him by ſome other name, with which we preſume he knows its connection, or appeal to the object where the idea itſelf is found. Thus, was any one to aſk the meaning of the word *white*, we ſhould tell him it ſtood for the ſame idea as *albus* in *Latin*, or *blanc* in *French*; or if we thought him a ſtranger to theſe languages, might appeal to an object producing the idea, by ſaying it denoted the colour we obſerve in *ſnow* or *milk*. But this is by no means a definition of the word exciting a new idea in his underſtanding, but merely a contrivance to remind him of a known idea, and teach him its connection with the eſtabliſhed name. For if the idea after which he enquires, has never yet been raiſed in his mind; as ſuppoſe one who had ſeen no other colours than *black* and *white*, ſhould aſk the meaning of the word *ſcarlet*, it is eaſy to perceive that it would be no more poſſible to make him comprehend it by words or a definition, than to diſcourſe the ſame perception into the imagination of a man born blind. The only method in this caſe is, to preſent ſome object, by looking at which the perception itſelf may be excited, and thus he will learn both the name and the idea together.

Experience and obſervation

V. Should any one's curioſity now prompt him to enquire, how it bring men to an agreement in the names of ſimple ideas.

comes to paſs that men agree in their names of the ſimple ideas, ſeeing they cannot view the perceptions in one another's minds, nor make known theſe perceptions by words to others? I anſwer, That the effect here mentioned is produced by experience and obſervation. Thus finding, for inſtance, that the name *heat* is annexed to that impreſſion which men feel when they approach the fire, I make it alſo the ſign of the idea excited in me by ſuch an approach, nor have any doubt but it denotes the ſame perception in my mind as in theirs. For we are naturally led to imagine that the ſame objects operate alike upon the organs of the human body, and produce an uniformity of ſenſations. No man fancies that the idea raiſed in him by the taſte of *ſugar*, and which he calls *ſweetneſs*, differs from that excited in another by the like means; or that *wormwood*, to whoſe reliſh he has given the epithet *bitter*, produces in others the ſenſation which he denotes by the word *ſweet*. Preſuming therefore upon this conformity of perceptions, when they ariſe from the ſame objects, we eaſily agree as to the names of our ſimple ideas; and if at any time, by a more narrow ſcrunity into things, new ideas of this claſs come in our way, which we chooſe to expreſs by terms of our own invention, theſe names are explained not by a definition, but by referring to the objects whence the ideas themſelves may be obtained.

The convey-ance of com-plex ideas by definitions, a wiſe contri-vance in na-ture;

VI. Being in this manner furniſhed with ſimple ideas, and the names by which they are expreſſed, the meaning of terms that ſtand for complex ideas is eaſily got, becauſe the ideas themſelves anſwering to theſe terms, may be conveyed into the mind by definitions. For our complex notions, as was already obſerved, are only certain combinations of ſimple ideas. When therefore theſe are enumerated, and the manner in which they are united into one conception explained, nothing more is wanting to raiſe that conception in the underſtanding; and thus the term denoting it comes of courſe to be underſtood. And here it is worth while to reflect a little upon the wiſe contrivance of nature, in thus furniſhing us with the very apteſt means of communicating our thoughts; for, were it not ſo ordered, that we could thus convey our complex ideas from one to another by definitions, it would in many caſes be impoſſible to make them known at all. This is apparent in thoſe ideas which are the proper work of the mind; for, as they exiſt only in the underſtanding, and have no real objects in nature, in conformity to which they are framed, if we could not make them known by a deſcription, they muſt lie for ever hid within our own breaſts, and be confined to the narrow acquaintance of a ſingle mind. All the fine ſcenes that riſe from time to time in the poet's fancy, and by his lively painting, give ſuch entertainment to his readers, were he deſtitute of this faculty, of laying them open to the view of others by words and deſcriptions, could not extend their influence beyond his own imagination, or give joy to any but the original inventor.

and of great avail towards the improvement of knowledge.

VII. There is this farther advantage in the ability we enjoy of communicating our complex notions by definitions; that as theſe make by far the largeſt claſs of our ideas, and moſt frequently occur in the progreſs and improvement of knowledge, ſo they are by this means imparted with the greateſt readineſs, than which nothing could tend more to the increaſe and ſpreading of ſcience; for a definition is ſoon peruſed, and if the terms of it are well underſtood, the idea itſelf finds an eaſy admiſſion into the mind: whereas in ſimple perceptions, where we are referred to the objects producing them, if theſe cannot be come at, as is ſometimes the caſe, the names by which they are expreſſed muſt remain empty ſounds. But new ideas of this claſs occurring very rarely in the ſciences, they ſeldom create any great obſtruction: it is otherwiſe with our complex notions, for every ſtep we take, leading us into new combinations and views of things, it becomes neceſſary to explain theſe to others before they can be made acquainted with our diſcoveries: and as the manner of definitions is eaſy, acquiring no apparatus but that of words, which are always ready and at hand, hence we can with the leſs difficulty remove ſuch obſtacles as might ariſe from terms of our own invention, when they are made to ſtand for new complex ideas, ſuggeſted to the mind by ſome preſent train of thinking: and thus at laſt we are let into the myſtery hinted at in the beginning of this chapter, *viz.* how we may become acquainted with the thoughts of another, when he makes uſe of words to which we have as yet joined no ideas. The anſwer is obvious, from what has been already ſaid. If the terms denote ſimple perceptions, he muſt refer us to thoſe objects of nature whence the perceptions themſelves are to be obtained; but if they ſtand for complex ideas, their meaning may be explained by a definition. As for the names of ſimple ideas, I ſhall here diſmiſs them, it being ſufficient to take notice, that our knowledge this way can be extended only by experience and obſervation. But the theory of definitions making a material part of Logic, and being indeed of great importance towards the improvement of human knowledge, it will be neceſſary to lay it a little more open to the view of the reader.

The compoſition and reſolution of our complex ideas.

VIII. Complex ideas are, as has been already ſaid, no other than ſimple ideas put together in various forms. But then it is to be obſerved, that in making theſe collections, the mind is not always tied down to the immediate view of the ſimple perceptions out of which they are framed. For if we ſuppoſe the underſtanding already furniſhed with a conſiderable ſtock of compound notions, theſe again may be made the conſtituent parts of others ſtill more compounded, inſomuch that the new idea thence ariſing may be termed a combination of complex conceptions. Thus the idea annexed to the word *animal*, includes many perceptions under it, as life, ſenſe, ſpontaneous motion, *&c.* In like manner, by the term *rational*, we denote a variety of ſimple ideas. If now combining theſe two conceptions together, we form the ſtill more complex notion of a rational animal, the idea thus got is truly a collection of compound notices. In a word, the ſame thing happens here as in numbers, which we may conſider not only as various collections of units, theſe being indeed their original and conſtituent parts, but alſo as ſometimes compoſed of other leſſer numbers; which all put together make up the reſpective ſums. Now in tracing any very large number, when for the eaſe of the mind we conſider it at firſt as compoſed of various others ſtill leſſer, if we next take theſe leſſer parts to pieces, and purſue them continually until we arrive at the units out of which they are compoſed, we thereby totally unravel the collection; and being able to puſh our reſearches no farther, reſt ſatisfied in the view thus offered to the underſtanding. Juſt ſo it is in the examination of our complex ideas. For when any very compounded notion comes under the inſpection of the mind in order to be traced to its firſt principles, we begin with reſolving it into other ideas leſs complicated; and taking theſe again to pieces one by one, ſtill go on with the ſearch, until we have broken the whole into our firſt and ſimple perceptions, beyond which the purſuit cannot poſſibly be carried. And this is the reaſon why I have all along called our ſimple ideas the foundation and ground-work of human knowledge; becauſe in unravelling the conceptions of the mind, we find ourſelves at length bounded by theſe ideas, which are indeed the laſt reſort of the underſtanding.

The names of ſimple ideas may be conſidered as the

IX. From what has been ſaid, it will be eaſy to conceive how, in defining a term ſtanding for any very elementary parts of language.

complex idea, other terms may be introduced that alſo denote compound ideas, though of an inferior claſs: for the firſt idea being reſolvable into others leſs complicated, the definition which enumerates theſe component ideas muſt conſiſt of the names by which they are expreſſed: and if it ſo happen, that the ideas of this ſecond claſs are alſo unknown, their terms too ought to be ſtill farther defined. In this manner may a ſeries of definitions be carried on until we arrive at the names of ſimple ideas, which not being definable, the analyſis muſt neceſſarily ceaſe: and thus we ſee that as the ſimple ideas are the materials and foundation of knowledge, ſo the names of ſimple ideas may be conſidered as the elementary parts of language, beyond which we cannot trace the meaning and ſignification of words. When we come to them, we ſuppoſe the ideas they ſtand for already known; or if they are not, experience alone muſt be conſulted, and not definitions or explications. And here it is well worth our notice, that as the names of theſe our original conceptions conſtitute the primary and fundamental articles of ſpeech, upon which the whole ſuperſtructure of human language is built, ſo they are of all others the leaſt doubtful and uncertain in their ſignification; becauſe, ſtanding each for one ſimple perception, not precariouſly excited into the mind, but the effect of certain powers in things fitted to produce that ſenſation in us, there is no danger of error or miſtake. He that once knows ſweetneſs to be the name of the taſte received from ſugar, *whiteneſs* of the colour in ſnow or milk, and *heat* of the ſenſation produced by approaching the fire, will not be apt to miſapply thoſe words, or annex them to perceptions of a different kind. And as the names of complex ideas may all be reſolved into theſe primitive terms, it is apparent that we are ſufficiently provided with the means of communicating our thoughts one to another; and that the miſtakes ſo frequently complained of on this head, are wholly owing to ourſelves, in not ſufficiently defining the terms we uſe, or perhaps not connecting them with clear and determinate ideas.

CHAP. VI.

Of Definition, and its ſeveral Kinds.

The variety of definition proceeds from the various application of words.

I. HAVING laid theſe foundations, ſhewn what words are and what are not definable, and taught the manner of reſolving our notions, as well as language itſelf, into its firſt and original principles, we now proceed to explain a little more particularly the nature of a definition, and the ſeveral kinds made uſe of according to the different views men have in communicating their thoughts one to another. Definitions are intended to make known the meaning of words ſtanding for complex ideas; and were we always careful to form thoſe ideas exactly in our minds, and copy our definitions from that appearance, much of the confuſion and obſcurity complained of in languages might be prevented. But unhappily for us, we are by no means ſteady in the application of names, referring them ſometimes to one thing, ſometimes to another; which often creates great uncertainty in their ſignification, and obliges us to give a different turn to our definitions, according to the different reference of the terms defined. In order therefore to render this whole matter as clear and obvious as poſſible, we ſhall firſt conſider to what it is that names, in the uſe of language, are moſt commonly applied; and then, from the variety of this application, endeavour to account for the ſeveral methods of defining, mentioned in the writings of logicians.

Words have a threefold reference; to our own ideas, thoſe of others,

II. Words then have manifeſtly a threefold reference: Firſt, and more immediately, they denote the ideas in the mind of him who uſes them;

and this is their true and proper ſignification. When a man ſpeaks, it is that he may be underſtood; and the words he employs to convey his thoughts, are ſuch as by uſe he has learnt to connect with the ideas then preſent to his mind. But becauſe thoſe with whom we converſe are alſo ſuppoſed to know the meaning of the terms we uſe, hence, Secondly, We conſider our words as ſigns likewiſe of the ideas in their minds: and this is the foundation of what is called propriety in language, when men take care to affix ſuch notions to their words as are commonly applied to them by thoſe of moſt underſtanding in the country where they live. The third and laſt reference of words is to things themſelves: for many of our ideas are taken from the ſeveral objects of nature wherewith we are ſurrounded; and being conſidered as copies of things really exiſting, the words by which they are expreſſed, are often transferred from the ideas themſelves, to ſignify thoſe objects which they are ſuppoſed to repreſent. Thus the word *ſun*, not only denotes the idea excited in the mind by that ſound, but is alſo frequently made to ſtand for the luminous body itſelf which inhabits the center of this our planetary ſyſtem. Now, according to this threefold application of names, their definitions and the manner of explaining them muſt be various;

and the real being of things.

for it is one thing to unfold the ideas in a man's own mind; another to deſcribe them as they are ſuppoſed to make their appearance in the minds of others; and laſtly, it is ſomething ſtill different to draw images or pictures that ſhall carry in them a conformity to the being and reality of things. But we ſhall treat of each in order.

Definitions of the name teach only the connection of our words and ideas, and are therefore arbitrary.

III. Firſt then, When we conſider words as ſigns of the ideas in the mind of him who uſes them, a definition is nothing elſe but ſuch an explication of the meaning of any term as that the complex idea annexed to it by the ſpeaker may be excited in the underſtanding of him with whom he converſes: and this is plainly no more than teaching the connection of our words and ideas, that others may underſtand the ſenſe of our expreſſions, and know diſtinctly what notions we affix to the terms we uſe. When we ſay, for inſtance, that by the word *ſquare* we mean a figure bounded by four equal ſides, joined together at right angles, what is this but a declaration that the idea of a quadrilateral, equilateral, rectangular figure, is that which in diſcourſe or writing we connect with the term *ſquare?* This is that kind of definition which logicians call the *definition of the name*, becauſe it diſcovers the meaning of the words or *names* we make uſe of, by ſhewing the ideas for which they ſtand. Now as ſounds are of themſelves indifferent to ſignify any ideas, hence it is plain that the definitions of names are arbitrary, every man having a liberty to affix what notions he pleaſes to his words; but the convenience of communication making it neceſſary for men ſpeaking the ſame language to agree as nearly as poſſible in the ſignification of ſounds, a conformity has accordingly been ſtudied. Nevertheleſs, we find that differences will from time to time creep in, which muſt create great confuſion in mens diſcourſes and reaſonings, if they are not careful to define their terms, that their ſignification may be kept fixed and ſteady, and lie always open to the view of the mind. The writings of the mathematicians are a clear proof how much the advancement of human knowledge depends upon a right uſe of definitions; for as by means of them they everywhere preſerve the ſame determined ſignification to their words, hence there is little diſpute as to the meaning of their expreſſions, almoſt all men underſtanding them in the ſame ſenſe: And thus it happens, that ſuch as apply their thoughts this way, having perfectly the ſame views of things, readily comprehend the diſcoveries already made, and are thereby enabled with joint labour and an exact conformity of notions to carry on the improvement of this branch of knowledge. And if men in other parts of learning, were alike careful to fix the meaning of their terms, the progreſs of ſcience muſt be greatly furthered, and all thoſe verbal diſputes, that now ſo much interrupt the courſe of our improvement, might be prevented.

Definitions of the name not always true and real definitions;

IV. This then ought to be our firſt care, when we enter upon a deſign of illuſtrating any particular branch of ſtudy,—to aſcertain our ideas, and mark the names by which they are expreſſed: and although definitions of words are indeed arbitrary (for a man may affix what ideas he pleaſes to his terms, nor can any one conteſt this liberty with him) yet it will be proper to conform as near as poſſible to common acceptation, that thereby our thoughts may find a more eaſy and ready entrance into the minds of others. If it ſhould now be aſked, What are the rules of a good definition? I anſwer, That as in definitions of the name, we aim at no more than teaching the connection of words and ideas,—every contrivance, by which we are enabled to excite the idea annexed to any word in the mind of another, will ſerve the purpoſe of a definition. Now the ideas we join with our words are of two kinds: either ſuch as we have reaſon to believe are already in the minds of others, though perhaps they know not the names by which they are called, or ſuch as, being new and of our own formation, can be no otherwiſe made known than by a deſcription. In the firſt caſe, there is no neceſſity for laying open the idea itſelf, becauſe, being already known, any contrivance to remind us of it is ſufficient. When we ſay, for inſtance, that a *clock is an inſtrument by which we meaſure the hours of the day*, it is plain that the idea anſwering to the word *clock*, is not here unfolded; but we being beforehand ſuppoſed to have an idea of this inſtrument, are only taught by what name it is called. Now, in this ſenſe the names of even ſimple ideas may be defined; for by ſaying that *white* is the colour we obſerve in ſnow or milk, *heat* the ſenſation produced by approaching the fire, we ſufficiently make known what ideas we connect with the terms *white* and *heat*, which is the true purpoſe of a definition of the name. Hence it appears, that many of thoſe explanations of words, which logicians call definitions of the name, are not definitions in a true and proper ſenſe; that is, ſuch deſcriptions of ideas as would ſerve to excite them in the mind of another, even ſuppoſing him before wholly unacquainted with them, but merely contrivances to remind us of known ideas, and teach us the names by which they are called.

But only when they coincide with the definition of the thing.

V. But where the ideas we join with our words are new and of our own formation, there they are to be laid open by a deſcription; becauſe, being ſuppoſed unknown to others, we muſt firſt raiſe them in their minds before they can learn to connect them with any particular names: and here it is that the *definition of the name* coincides with what logicians call the *definition of the thing*, as in either caſe we proceed by unfolding the idea itſelf for which the term defined ſtands. And indeed this alone is what conſtitutes a definition in the true and proper ſenſe of the word, as will appear more fully afterwards, when we come to conſider the terms we uſe as referred to the real objects of nature. We ſhall therefore poſtpone this conſideration of the definition of the name, till we come to treat of the definition of the thing; when it will more naturally fall in our way. It may not however be amiſs to obſerve, that when we ſay the definitions of the name are arbitrary, we mean not that the deſcriptions of ideas are ſo too; for every idea having a peculiar appearance of its own, by which it is diſtinguiſhed from all others, nothing is more evident than that the deſcription muſt be ſuch as to exhibit that preciſe conception. But then the connection of any idea with the name by which it is expreſſed, being, as we have ſaid, wholly arbitrary, the conſidering the deſcription of that idea as the definition of that particular name, muſt be ſo to; ſo that, although definitions conſidered as deſcriptions of our ideas are ſteady and invariable, yet the application of them to particular ſounds (which is all that we underſtand by the definition of the name) is wholly a work of our own free choice.

Definition of words, according to the common uſe of language, not arbitrary.

VI. But, ſecondly, beſides conſidering words as the ſigns of our own ideas, we are alſo very apt on many occaſions to refer them to the ideas in the minds of other men. Now, to define a term in this view, is to inveſtigate its meaning or acceptation, according to the common uſe of ſpeech. Here then it is plain that definitions are not arbitrary; for although in regarding words as the marks of our own ideas, we may give them what meaning we pleaſe; yet when we conſider them in reference to the thoughts of others, they have a fixed and ſteady ſignification; namely, that which cuſtom and the propriety of language has aſſigned them. The words *ability* and *genius* may by any man be made to ſtand for one and the ſame idea in his own mind; and if he takes care to advertiſe us of this, he is at liberty to uſe them promiſcuouſly: but if the common courſe of language hath confined the word *genius* to expreſs the natural ſtrength and talents of the mind,—and the word *ability* to denote thoſe which are acquired, whoever pretends to explain the proper acceptation of theſe terms, is bound to take notice of this difference. As propriety of ſpeech makes our language intelligible, and gives our thoughts a ready entrance into the minds of others, it well deſerves our application and care. The beſt way to acquire it is from the writings and diſcourſes of thoſe who ſeem to have had the cleareſt notions, and to have applied their terms with the exacteſt choice and fitneſs.

Definition of the thing refer to the real objects of nature.

VII. We come now to the third and laſt ſpecies of definition, that namely which conſiders words as referred to things themſelves. And here it is plain we are not at liberty to feign and faſhion our explications at pleaſure, but being tied down to the real objects of nature, muſt ſtudy a conformity to things themſelves. When we define for inſtance the *ſun*, conſidered as that being who poſſeſſes the center of our ſyſtem, and diffuſes heat and light to the planets around him, it is not enough that we give an account of the idea anſwering to that word in our minds; we muſt further take care that the idea itſelf carries in it a real conformity to the object it is ſuppoſed to repreſent; and hence it is, that all definitions of this kind, when juſtly made, are in reality pictures or repreſentations, taken from the being and exiſtence of things; for they are intended to expreſs their nature and properties, ſo as to diſtinguiſh them from all others, and exhibit them clearly to the view of the mind. 'Tis for this reaſon that logicians call them *definitions of things*, becauſe they are ſuppoſed to refer not ſo much to the ideas in the underſtanding, as to the things themſelves repreſented by thoſe ideas.

Ground of the diſtinction between the definition of the name and of the thing.

VIII. And this alſo lets us into the ground of that diſtinction ſo univerſally received, between definitions of the name and the thing. The firſt are arbitrary, and not liable to debate or contradiction. The ſecond are propoſitions capable of proof and illuſtration, and which may therefore be conteſted. The reaſon is obvious. Definitions of the name ſerve only to mark what ideas we connect with our words: and as ſounds are of themſelves indifferent to ſignify any ideas, we are entirely at liberty to affix to them what notions we pleaſe. But it is otherwiſe in the definition of the thing; for here our words ſerving to denote particular beings in nature, cannot be the ſigns of any ideas at pleaſure, but of ſuch only as carry in them a conformity to the ſeveral objects to which the words refer. A man may uſe the term *ſquare*, to expreſs that idea which others denote by the word *triangle*, and define it accordingly. In this caſe indeed he recedes from the common forms of ſpeech; but his definition cannot be charged with falſehood. He tells us that by a *ſquare* he means a three-ſided figure: and who can diſpute the truth of this, if he really all along uſes the word in that ſenſe? I would only obſerve, that by changing thus the meaning of words, we change not things themſelves, or their relations and habitudes one towards another. Theſe are at all times the ſame and invariable, nor have any dependence upon the fancy and caprice of men. It is true the properties of the *triangle* may after this definition be affirmed of the *ſquare*; but, as in either caſe, the idea to which theſe properties belong is the ſame; the propoſitions only expreſſing our judgments, and not our judgments themſelves, ſuffer a ſeeming variation.

A previous connection between names and things, cuts off all arbitrary explications.

IX. But where words are made to denote particular objects, previous to any definitions given, there arbitrary explications cannot have place; for in this caſe we are not put upon explaining what ideas we connect with our words, but a connection being already ſuppoſed between the name and the thing ſignified, our buſineſs is to unfold that idea by which the object itſelf is moſt clearly and diſtinctly repreſented. Thus the word *gold* denotes that metal which is of higheſt value among men, and goes fartheſt in the way of commerce. This connection being once ſettled, we are no longer left to arbitrary definitions, but muſt deſcribe it by ſuch properties as are really to be found in it, and will beſt ſerve to diſtinguiſh it when it comes in our way; as by ſaying it is *a ſubſtance*, *yellow*, *very heavy*, *malleable*, *fuſible*, &c.

Why mathematical definitions have been accounted mere definitions of the name,

X. From what has been ſaid, it appears, that in the language of logicians, definitions of the thing reſpect only ſubſtances and beings that have a real exiſtence in nature; ſerving to deſcribe them by their properties and attributes. And this I doubt not is the reaſon that the definitions of the mathematicians are not conſidered as definitions of the thing but of the name, becauſe the ideas therein deſcribed are the mere creatures of the underſtanding, and not ſuppoſed to be copied from patterns exiſting without us. A circle, a triangle, a ſquare, &c. ſuch as mathematicians conceive them, are nowhere to be found in nature that we know of. Hence it might juſtly be accounted abſurd, to call our definitions of theſe *definitions of the thing*, when they ſerve not to deſcribe any real objects of nature, but merely to unfold the conceptions of the mind: and yet if we look into the matter narrowly, we ſhall find that the rules followed in theſe definitions are preciſely the ſame with thoſe which logicians have laid down for the definition of the thing. All the ſeveral ſpecies of figures are deſcribed by their properties, ſome of which are common to different ranks, others peculiar to the tribe defined. The common properties conſtitute what logicians call the *genus*, and thoſe that are peculiar the *difference*. Now the *genus* and *difference* make up the logical definition of the thing, as will be more clearly underſtood from what follows.

when yet they coincide with the logical definition of the thing, and therefore ought not to be accounted arbitrary.

XI. I am therefore apt to think, that mathematical definitions, as they are of the ſame general form with the definitions of ſubſtances, and ſubject to the ſame rules, have been improperly conſidered as mere definitions of the name, in which we are left wholly to arbitrary explications; for, however we may change the name of one figure for another in diſcourſe or writing, uſing the term *ſquare* to denote a *triangle*, or the word *triangle* to expreſs a *ſquare*, it is certain the ideas themſelves are invariable, and no leſs capable of being diſtinguiſhed by their properties than the ſeveral ſpecies of ſubſtances. Thus, if we ſuppoſe the word *ſquare* to denote that ſpecies of figures whoſe ſides ſeverally ſubtend quadrants of a circumſcribed circle, we ſhall find ourſelves equally ſhut out from arbitrary explications, as in the definition of the names of ſubſtances; for, as this happens in no figures but thoſe which are bounded by four equal ſides joined together at right angles, it follows evidently, that the true and proper definition of a *ſquare*, is that which exhibits the preciſe idea here mentioned, and no other, to the mind. And thus it appears that the common diviſion of definitions into thoſe of the name and thing, is not ſufficiently calculated to give us right apprehenſions as to what is and what is not arbitrary in the explication of words. It may not therefore be improper, if we here endeavour to clear up this matter a little, and free it from thoſe obſcurities in which it has hitherto been involved. To this end we ſhall premiſe the following obſervations.

Definitions, properly ſpeaking, never regard things, but merely our own ideas.

XII. 1. Firſt, That whatever logicians may pretend about the definition of the thing, it is yet certain that none of our definitions, when purſued to their ſource, regard immediately things themſelves, but merely the ideas in our own minds. This I doubt not will appear a paradox to many, who will be apt to enquire, Whether the definition of *gold* be not taken from that metal, independent of the various conceptions of men about it? To this I anſwer, That indeed in framing our idea of *gold*, we regard chiefly the thing itſelf, uniting in our conception ſuch properties as are moſt conſpicuous, and ſerve beſt to diſtinguiſh it from other metals, to which it may bear any reſemblance. But as it is by this idea alone that gold is known to us, ſo in deſcribing it to others, we aim at nothing more than to transfer the ſame conception into their minds. Now this can no otherwiſe be done but by enumerating the ſeveral properties out of which our own complex notion is formed. And indeed it were in the higheſt degree abſurd to imagine, that men in explaining things to others, ſhould make uſe of any marks or characters but thoſe by which they are known to themſelves. Hence it comes to paſs, that all our definitions, are in fact nothing elſe but tranſcripts of the ideas in our minds. Where theſe are imperfect, the definitions muſt be ſo too; where they are juſt and adequate, the copies taken from them, if drawn out with accuracy and care, cannot fail to exhibit the object deſcribed. And this will very well ſerve to account for that great diverſity of definitions we often meet with, even of one and the ſame object; becauſe men, in conſequence of their different purſuits and applications, fallling often into different views of things, muſt needs vary no leſs in their definitions than in the ideas themſelves from which theſe definitions are copied. He whoſe obſervation goes no farther than the more obvious qualities of gold, will content himſelf with deſcribing it by its colour, weight, and perhaps malleability and fuſibility. On the other hand, a goldſmith having enquired farther into the nature of that metal, and finding ſeveral other properties that equally belong to it, will be apt to take theſe alſo into his complex idea, and accordingly introduce them in a definition. Hence his deſcription will add to the former, fixedneſs and ſolubility in *aqua regia*, &c. and ſo in proportion as mens various purſuits lead them into a more accurate examination of things, their explications will take a different turn, ſuitable to the ideas they have framed within themſelves.

Diſtinction between the definition of the name and thing uſeleſs, and to be rejected.

XIII. 2. This then being evident, that our definitions reſpect not things themſelves, but the ideas in our own minds, I would in the next place obſerve, that the diſtinction of them into thoſe of the name and thing, is altogether uſeleſs, and tends rather to miſlead us than give right apprehenſions of the ſubject in hand; for thus, men are apt to fancy that many of their definitions are expreſſive of the real eſſence of things, whereas they are in truth no more than tranſcripts of their own ideas: and as it ſometimes falls out that theſe ideas are not collected with ſufficient care from the objects they repreſent, we find by experience that a miſtaken idea never fails to occaſion a miſtake alſo in the definition. But this could not happen were our definitions copied from things themſelves, becauſe, their eſſences being immutable and always the ſame, the definition would in this caſe ſerve to correct the idea, and might be conſidered as a ſtandard by which to judge whether the idea was rightly framed. I deny not that words are often transferred from our ideas to ſignify the objects which theſe ideas repreſent; as when we talk of the ſun, the earth, men, and other animals: but then let it be obſerved, that as theſe objects are only known to us by the ideas of them in our minds, ſo in deſcribing them to others, all we aim at is, diſtinctly to lay open our conceptions about them. Hence it appears, that what logicians call a *definition of the things* is in truth no more than an unfolding of the idea by which that thing is repreſented to the underſtanding. But now in mathematical definitions, and indeed all others whatſoever, this alſo is our whole aim and intent, to exhibit and lay open thoſe ideas of which the words we uſe are the ſigns. And thus it happens, that in innumerable inſtances, what logicians call the *definition of the name*, is yet found to coincide with and proceed by the very ſame rules as the *definition of the thing*; which clearly demonſtrates the neceſſity of baniſhing this frivolous diſtinction, and eſtabliſhing ſome preciſe and determinate notion, expreſſive of the true nature of a definition, and comprehending it in its full extent.

Definitions in all caſes deſcriptions of our ideas.

XIV. Nor will this appear ſo difficult a taſk, if we call to mind that words are in all caſes the ſigns of our ideas, and no otherwiſe ſignify things than as they ſtand for thoſe ideas by which things are repreſented to the underſtanding. By defining our words therefore, we can mean no more than the laying open to the view of others the ideas of which theſe words are the ſigns; for thus it is that the meaning of our expreſſions come to be known, and that we find ourſelves capable of transferring our thoughts and conceptions into the minds of thoſe with whom we converſe. Where words are referred to things themſelves, there we explain the ideas by which theſe things are repreſented; where they denote conceptions framed by the mind, there we lay open theſe conceptions, and endeavour to exhibit them according to their real appearance within our own breaſts. But in both caſes it is our own ideas;

it is the perceptions of our own minds, either as taken from things without, or framed by the underſtanding itſelf, that we explicate and unfold.

Not arbitrary, as being confined to the repreſentation of certain determinate notions.

XV. And thus we have at length ſettled the true and genuine notion of a definition, comprehending all its varieties, from whatever ſcience taken, or to whatever object extended; for from what we have ſaid it evidently follows, that a definition *is the unfolding of ſome conception of the mind, anſwering to the word or term made uſe of as the ſign of it.* Now, as in exhibiting any idea to another, it is neceſſary that the deſcription be ſuch as may excite that preciſe idea in his mind, hence it is plain that definitions, properly ſpeaking, are not arbitrary, but confined to the repreſenting of certain determinate ſettled notions, ſuch namely as are annexed by the ſpeaker or writer to the words he uſes. As nevertheleſs it is univerſally allowed that the ſignification of words is perfectly voluntary, and not the effect of any natural and neceſſary connection between them and the ideas for which they ſtand, ſome may perhaps wonder why definitions are not ſo too. In order therefore to unravel this difficulty, and ſhew diſtinctly what is and what is not arbitrary in ſpeech, we muſt carefully diſtinguiſh between the connection of our words and ideas, and the unfolding of the ideas themſelves.

The connection between words and ideas, a perfectly voluntary eſtabliſhment.

XVI. Firſt, As to the connection of our words and ideas, this it is plain is a purely arbitrary inſtitution. When for inſtance we have in our minds the idea of any particular ſpecies of metals, the calling it by the name *gold*, is an effect of the voluntary choice of men ſpeaking the ſame language, and not of any peculiar aptneſs in that ſound to expreſs that idea. Other nations we find make uſe of different ſounds, and with the ſame effect. Thus *Aurum* denotes that idea in *Latin*, and *Or* in *French*. And even the word *gold* itſelf, would have as well ſerved to expreſs the idea of that metal which we call *ſilver*, had cuſtom in the beginning ſo eſtabliſhed it.

The deſcriptions of ideas not ſo, but bounded to the repreſentation of that preciſe appearance by which they are diſtinguiſhed among themſelves.

XVII. But although we are thus entirely at liberty, in connecting any idea with any ſound, yet it is quite otherwiſe in unfolding the ideas themſelves; for every idea, having a preciſe appearance of its own, by which it is diſtinguiſhed from every other idea, it is manifeſt that, in laying it open to others, we muſt ſtudy ſuch a deſcription as ſhall exhibit that peculiar appearance. When we have formed to ourſelves the idea of a figure bounded by four equal ſides, joined together at right angles, we are at liberty to expreſs that idea by any ſound, and may call it either a *ſquare* or a *triangle*. But whichever of theſe names we uſe, ſo long as the idea is the ſame, the deſcription by which we would ſignify it to another, muſt be ſo too. Let it be called *ſquare* or *triangle*, it is ſtill a figure having four equal ſides, and all its angles right ones. Hence we clearly ſee what is and what is not arbitrary in the uſe of words. The eſtabliſhing any ſound as the mark of ſome determinate idea in the mind, is the effect of free choice, and a voluntary combination among men; and as different nations make uſe of different ſounds to denote the ſame ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connection between our ideas and words is once ſettled, the unfolding of the idea anſwering to any word which properly conſtitutes a definition, is by no means an arbitrary thing; for here, as I have already obſerved, we are bound to exhibit that preciſe conception which either the uſe of language or our own particular choice hath annexed to the term we uſe.

Cauſes of the obſcurity that has hitherto perplexed the theory of definitions.

XVIII. And thus it appears that definitions, conſidered as deſcriptions of ideas in the mind, are ſteady and invariable, being bounded to the repreſentation of thoſe preciſe ideas. But then in the application of definitions to particular names, we are altogether left to our own free choice; becauſe, as the connecting of any idea with any ſound is a perfectly arbitrary inſtitution, the applying the deſcription of that idea to that ſound muſt be ſo too. When therefore logicians tell us that the definition of the name is arbitrary, they mean no more than this: That as different ideas may be connected with any term, according to the good pleaſure of him that uſes it, in like manner may different deſcriptions be applied to that term, ſuitable to the ideas ſo connected. But this connection being ſettled, and the term conſidered as the ſign of ſome fixed idea in the underſtanding, we are no longer left to arbitrary explications, but muſt ſtudy ſuch a deſcription as correſponds with that preciſe idea. Now this alone, according to what has been before laid down, ought to be accounted a definition. What I am apt to think has occaſioned no ſmall confuſion in this matter, is, that many explanations of words, where no idea is unfolded, but merely the connection between ſome word and idea aſſerted, have yet been dignified with the name of definitions. Thus in the inſtance before given, when we ſay that *a clock is an inſtrument by which we meaſure time*, this is by ſome called a definition; and yet it is plain that we are beforehand ſuppoſed to have an idea of this inſtrument, and only taught that the word *clock* ſerves in common language to denote that idea. By this rule all explications of words in our dictionaries will be definitions; nay, as was already obſerved, the names of even ſimple ideas may be thus defined. *White* we may ſay is the colour we obſerve in ſnow or milk, *heat* the ſenſation produced by approaching the fire, and ſo in innumerable other inſtances. But theſe, and all others of the like kind, are by no means definitions exciting new ideas in the underſtanding, but merely contrivances to remind us of known ideas, and teach their connection with the eſtabliſhed names. It is nevertheleſs worth our notice, that what logicians call definitions of the name, extend properly no farther than theſe explanations, ſerving to mark the connection of our ideas and words; and are therefore juſtly accounted arbitrary, inaſmuch as the connections themſelves are altogether ſo.

Complex ideas alone capable of that kind of deſcription which goes by the name of a definition.

XIX. But now in definitions properly ſo called, we firſt conſider the term we uſe as the ſign of ſome inward conception, either annexed to it by cuſtom, or our own free choice; and then the buſineſs of the definition is to unfold and explicate that idea. As therefore the whole art lies in giving juſt and true copies of our ideas, a definition is then ſaid to be perfect when it ſerves diſtinctly to excite the idea deſcribed in the mind of another, even ſuppoſing him before wholly unacquainted with it. This point ſettled, let us next enquire into what thoſe ideas are which are capable of being thus unfolded. And in the firſt place, it is evident, that all our ſimple ideas are neceſſarily excluded. We have ſeen already, that experience alone is to be conſulted here, inſomuch that if either the objects whence they are derived come not in our way, or the avenues appointed by nature for their reception are wanting, no deſcription is ſufficient to convey them into the mind. But where the underſtanding is already ſupplied with theſe original and primitive conceptions, as they may be united together in an infinity of different forms, ſo may all their ſeveral combinations be diſtinctly laid open by enumerating the ſimple ideas concerned in the various collections, and tracing the order and manner in which they are linked one to another. Now theſe combinations of ſimple notices conſtitute what we call our complex notions; whence it is evident that complex ideas, and thoſe alone, admit of that kind of deſcription which goes by the name of a Definition.

When a complex idea may be ſaid to be fully unfolded.

XX. The buſineſs of definitions is now I think pretty plain. They are, as we have ſeen, pictures or repreſentations of our ideas; and as theſe repreſentations are then only poſſible when the ideas themſelves are complex, it is obvious to remark, that definitions cannot have place but where we make uſe of terms ſtanding for ſuch complex ideas. But perhaps the reader may ſtill expect that we ſhould enter a little more particularly into the nature of a definition, deſcribe its parts, and ſhew by what rules it ought to proceed, in order to the attainment of its proper end. To give therefore what ſatisfaction we are able upon this point, we muſt again call to mind, that the deſign of a definition is, ſo to unfold the idea anſwering to any term, as that it may be clearly and diſtinctly transferred into the mind of another. But now our complex ideas, which alone are capable of this kind of deſcription, being, as we have ſaid, nothing more than different combinations of ſimple ideas, we then know and comprehend them perfectly when we know the ſeveral ſimple ideas of which they conſiſt, and can ſo put them together in our minds as is neceſſary towards the framing of that peculiar connection which gives every idea its diſtinct and proper appearance.

Two things required in a definition: to enumerate the ideas, and explain the manner of their combination.

XXI. Two things are therefore required in every definition. Firſt, That all the original ideas, out of which the complex one is formed, be diſtinctly enumerated. Secondly, That the order and manner of combining them into one conception be clearly explained Where a definition has theſe requiſites, nothing is wanting to its perfection; becauſe every one who reads it, and underſtands the terms, ſeeing at once what ideas he is to join together, and alſo in what manner, can at pleaſure form in his own mind the complex conception anſwering to the term defined. Let us, for inſtance, ſuppoſe the word *ſquare* to ſtand for that idea, by which we repreſent to ourſelves a figure whoſe ſides ſubtend quadrants of a circumſcribed circle. The parts of this idea, are the ſides bounding the figure. Theſe muſt be four in number, and all equal among themſelves, becauſe they are each to ſubtend a fourth part of the ſame circle. But beſides theſe component parts, we muſt alſo take notice of the manner of putting them together, if we would exhibit the preciſe idea for which the word *ſquare* here ſtands; for four equal right lines, any how joined, will not ſubtend quadrants of a circumſcribed circle. A figure with this property, muſt have its ſides ſtanding alſo at right angles. Taking in therefore this laſt conſideration reſpecting the manner of combining the parts, the idea is fully deſcribed, and the definition thereby rendered complete; for a figure bounded by four equal ſides, joined together at right angles, has the property required, and is moreover the only right-lined figure to which that property belongs.

How we are to proceed to arrive at juſt and adequate definitions.

XXII. And now I imagine it will be obvious to every one in what manner we ought to proceed, in order to arrive at juſt and adequate definitions. Firſt, We are to take an exact view of the idea to be deſcribed, trace it to its original principles, and mark the ſeveral ſimple perceptions that enter into the compoſition of it. Secondly, We are to conſider the particular manner in which theſe elementary ideas are combined, in order to the forming of that preciſe conception for which the term we make uſe of ſtands. When this is done, and the idea wholly unravelled, we have nothing more to do than fairly tranſcribe the appearance it makes to our own minds. Such a deſcription, by diſtinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite at the ſame time, in the mind of every one that reads it, the complex idea reſulting from them; and therefore attains the true and proper end of a definition.

CHAP. VII.

Of the Compoſition and Reſolution of our Ideas, and the Rules of Definition thence ariſing.

In compounding our ideas we proceed by a ſucceſſive gradation.

I. THE rule laid down in the foregoing chapter is general, extending to all poſſible caſes; and is indeed that to which alone we can have recourſe where any doubt or difficulty ariſes. It is not however neceſſary that we ſhould practiſe it in every particular inſtance. Many of our ideas are extremely complicated, inſomuch, that to enumerate all the ſimple perceptions out of which they are formed, would be a very troubleſome and tedious work. For this reaſon, logicians have eſtabliſhed certain compendious rules of defining, of which it may not be amiſs here to give ſome account. But, in order to the better underſtanding of what follows, it will be neceſſary to obſerve, that there is a certain gradation in the compoſition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are therefore fain to proceed by ſteps, and make our firſt advances ſubſervient to thoſe which follow. Thus, in forming our complex notions, we begin at firſt with but a few ſimple ideas, ſuch as we can manage with eaſe, and unite them together into one conception. When we are provided with a ſufficient ſtock of theſe, and have by habit and uſe rendered them familiar to our minds, they become the component parts of other ideas ſtill more complicated, and form what we may call a ſecond order of compound notions. This proceſs, as is evident, may be continued to any degree of compoſition we pleaſe, mounting from one ſtage to another, and enlarging the number of combinations.

Hence ideas of this claſs beſt comprehended when we advance gradually through all the ſeveral orders.

II. But now in a ſeries of this kind, whoever would acquaint himſelf perfectly with the laſt and higheſt order of ideas, finds it much the moſt expeditious method to proceed gradually through all the intermediate ſteps ; for was he to take any very compounded idea to pieces, and without regard to the ſeveral claſſes of ſimple perceptions, that have already been formed into diſtinct combinations, break in at once into its original principles, the number would be ſo great as perfectly to confound the imagination, and overcome the utmoſt reach and capacity of the mind. When we ſee a prodigious multitude of men jumbled together in crowds, without order, or any regular poſition, we find it impoſſible to arrive at an exact knowledge of their number. But if they are formed into ſeparate battalions, and ſo ſtationed as to fall within the leiſurely ſurvey of the eye; by viewing them ſucceſſively and in order, we come to an eaſy and certain determination. It is the ſame in our complex ideas. When the original perceptions, out of which they are framed, are very numerous, it is not enough that we take a view of them in looſe and ſcattered bodies; we muſt form them into diſtinct claſſes, and unite theſe claſſes in a juſt and orderly manner, before we can arrive at a true knowledge of the compound notices reſulting from them.

Our definitions ought to keep pace with our ideas, and obſerve a like gradation.

III. This gradual progreſs of the mind to its compound notions, through a variety of intermediate ſteps, plainly points out the manner of conducting the definitions by which theſe notions are conveyed into the minds of others; for as the ſeries begins with ſimple and eaſy combinations, and advances through a ſucceſſion of different orders, riſing one above another in the degree of compoſition, it is evident that in a train of definitions expreſſing theſe ideas, a like gradation is to be obſerved. Thus the complex ideas of the loweſt order, can no otherwiſe be deſcribed than by enumerating the ſimple ideas out of which they are made, and explaining the manner of their union. But then in the ſecond, or any ucceeding order, as they are formed out of thoſe gradual combinations that conſtitute the inferior claſſes, it is not neceſſary in deſcribing them to mention one by one all the ſimple ideas of which they conſiſt. They may be more diſtinctly and briefly unfolded by enumerating the compound ideas of a lower order, from whoſe union they reſult, and which are all ſuppoſed to be already known, in conſequence of previous definitions. Here then it is that the logical method of defining takes place; which, that we may the better underſtand, I ſhall explain ſomewhat more particularly the ſeveral ſteps and gradations of the mind in compounding its ideas, and thence deduce that peculiar form of a definition which logicians have thought fit to eſtabliſh.

The ſteps by which the mind proceeds from particular to general ideas.

IV. All the ideas we receive from the ſeveral objects of nature that ſurround us, repreſent diſtinct individuals. Theſe individuals, when compared together, are found in certain particulars to reſemble. Hence, by collecting the reſembling particulars into one conception, we form the notion of a *ſpecies*. And here let it be obſerved, that this laſt idea is leſs complicated than that by which we repreſent any of the particular objects contained under it; for the idea of the ſpecies excludes the peculiarities of the ſeveral individuals, and retains only ſuch properties as are common to them all. Again, By comparing ſeveral ſpecies together, and obſerving their reſemblance, we form the idea of the *genus*; where, in the ſame manner as before, the compoſition is leſſened, becauſe we leave out what is peculiar to the ſeveral ſpecies compared, and retain only the particulars wherein they agree. It is eaſy to conceive the mind proceeding thus from one ſtep to another, and advancing through its ſeveral claſſes of general notions, until at laſt it comes to the higheſt genus of all, denoted by the word *being*, where the bare idea of exiſtence is only concerned.

The conduct of the mind in compounding its ideas, as it advances thro' the different orders of perception.

V. In this procedure we ſee the mind unravelling a complex idea, and tracing it in the aſcending ſcale, from greater to leſs degrees of compoſition, until it terminates in one ſimple perception. If now we take the ſeries the contrary way, and beginning with the laſt or higheſt genus, carry our view downwards, through all the inferior genera and ſpecies, quite to the individuals, we ſhall thereby arrive at a diſtinct apprehenſion of the conduct of the underſtanding in compounding its ideas; for in the ſeveral claſſes of our perceptions, the higheſt in the ſcale is for the moſt part made up of but a few ſimple ideas, ſuch as the mind can take in and ſurvey with eaſe. This firſt general notion, when branched out into the different ſubdiviſions contained under it, has in every one of them ſomething peculiar, by which they are diſtinguiſhed among themſelves; inſomuch, that in deſcending from the genus to the ſpecies, we always ſuperadd ſome new idea, and thereby increaſe the degree of compoſition. Thus the idea denoted by the word *figure*, is of a very general nature, and compoſed of but few ſimple perceptions, as implying no more than ſpace everywhere bounded. But if we deſcend farther, and conſider the boundaries of this ſpace as that they may be either lines or ſurfaces, we fall into the ſeveral ſpecies of figure; for where the ſpace is bounded by one or more ſurfaces, we give it the name of a *ſolid figure*; but where the boundaries are lines, it is called a *plain figure*.

The idea of the ſpecies formed by ſuperadding the ſpecific difference to the genus;

VI. In this view of things, it is evident that the *ſpecies* is formed by ſuperadding a new idea to the *genus*. Here, for inſtance, the genus is circumſcribed ſpace. If now to this we ſuperadd the idea of a circumſcription by line, we frame the notion of that ſpecies of figures which are called *plain*; but if we conceive the circumſcription to be by ſurfaces, we have the ſpecies of *ſolid figures*. This ſuperadded idea is called the *ſpecific difference*, not only as it ſerves to divide the *ſpecies* from the *genus*, but becauſe, being different in all the ſeveral ſubdiviſions, we thereby alſo diſtinguiſh the *ſpecies* one from another. And as it is likewiſe that conception which, by being joined to the general idea, completes the notion of the *ſpecies*, hence it is plain that the *genus* and *ſpecific difference* are to be conſidered as the proper and conſtituent parts of the *ſpecies*. If we trace the progreſs of the mind ſtill farther, and obſerve it advancing thro' the inferior ſpecies, we ſhall find its manner of proceeding to be always the ſame; for every lower ſpecies is formed by ſuperadding ſome new idea to the ſpecies next above it; inſomuch that in this deſcending ſcale of our perceptions, the underſtanding paſſes thro' different orders of complex notions, which become more and more complicated at every ſtep it takes. Let us reſume here, for inſtance, the ſpecies of plain figures: they imply no more than ſpace bounded by lines. But if we take in an additional conſideration of the nature of theſe lines, as whether they are *right* or *curves*, we fall into the ſubdiviſions of plain figure, diſtinguiſhed by the names *Rectilinear*, *Curvilinear*, and *Mixtilinear*.

and in all the inferior ſpecies by ſuperadding the ſpecific dif-

VII. And here we are to obſerve, that tho' plain figures when conſidered as one of thoſe branches ference to the neareſt genus.

that come under the notion of figure in general, take the name of a ſpecies, yet compared with the claſſes of curvilinear, rectilinear, and mixtilinear, into which they themſelves may be divided, they really become a genus, of which the beforementioned ſubdiviſions conſtitute the ſeveral ſpecies. Theſe ſpecies, in the ſame manner as in the caſe of plain and ſolid figures, conſiſt of the genus and ſpecific difference as their conſtituent parts; for in the curvilinear kind, the curvity of the lines bounding the figure, makes what is called the *ſpecific difference*; to which if we join the genus, which here is plain figure, or ſpace circumſcribed by lines, we have all that is neceſſary towards completing the notion of the ſpecies. We are only to take notice, that this laſt ſubdiviſion having two genera above it, *viz.* plain figure and figure in general, the genus joined with the ſpecific difference, in order to conſtitute the ſpecies of curvilinears, is that which lies neareſt to the ſaid ſpecies. It is the notion of plain figure, and not of figure in general, that, joined with the idea of curvity, makes up the complex conception of curve-lined figures; for in this deſcending ſcale of our ideas, figure in general, plain figures, curve-lined figures, the two firſt are conſidered as genera in reſpect of the third; and the ſecond in order, or that which ſtands next to the third, is called the *neareſt genus.* But now, as it is this ſecond idea which, joined with the notion of *curvity*, forms the ſpecies of *curve-lined figures*, it is plain that the third or laſt idea in the ſeries, is made up of the *neareſt genus* and *ſpecific difference*. This rule holds invariably, however far the ſeries is continued; becauſe in a train of ideas thus ſucceeding one another, all that precede the laſt are conſidered as ſo many genera in reſpect of that laſt, and the laſt itſelf is always formed by ſuperadding the ſpecific difference to the genus next it.

The idea of an individual compoſed of the loweſt ſpecies and numeric difference.

VIII. Here then we have an univerſal deſcription, applicable to all our ideas of whatever kind, from the higheſt genus to the loweſt ſpecies; for, taking them in order downwards from the ſaid general idea, they everywhere conſiſt of the *genus proximum*, and *differentia ſpecifica*, as logicians love to expreſs themſelves. But when we come to the loweſt ſpecies of all, comprehending under it only individuals, the ſuperadded idea, by which theſe individuals are diſtinguiſhed one from another, no longer takes the name of the ſpecific difference; for here it ſerves not to denote diſtinct ſpecies, but merely a variety of individuals, each of which having a particular exiſtence of its own, is therefore *numerically* different from every other of the ſame kind. And hence it is, that in this laſt caſe, logicians chooſe to call the ſuperadded idea by the name of the *numerical difference*; inſomuch that as the idea of a ſpecies is made up of the *neareſt genus* and *ſpecific difference,* ſo the idea of an individual conſiſts of the *loweſt ſpecies* and *numeric difference*. Thus the circle is a ſpecies of curve-lined figures, and what we call the *loweſt ſpecies*, as comprehending under it only individuals. Circles in particular are diſtinguiſhed from one another by the length and poſition of their diameters. The length therefore and poſition of the diameter of a circle, is what logicians call the *numerical difference*; becauſe theſe being given, the circle itſelf may be deſcribed, and an individual thereby conſtituted.

Definitions to follow one another in train, and paſs through the ſame ſucceſſive gradations as our compound ideas.

IX. And thus we have endeavoured to trace, in the beſt manner we are able, the progreſs of the mind in compounding its ideas. It begins we ſee with the moſt general notions, which, conſiſting of but few ſimple notices, are eaſily combined and brought together into one conception. Thence it proceeds to the ſpecies comprehended under this general idea; and theſe are formed by joining together the *genus* and *ſpecific difference*: and as it often happens that theſe ſpecies may be ſtill further ſubdivided, and run on in a long ſeries of continued gradations, producing various orders of compound perceptions, ſo all theſe ſeveral orders are regularly and ſucceſſively formed, by annexing in every ſtep the *ſpecific difference* to the *neareſt genus*. When by this method of procedure, we are come to the loweſt order of all, by joining the *ſpecies* and *numeric difference*, we frame the ideas of individuals: and here the ſeries neceſſarily terminates, becauſe it is impoſſible any farther to bound or limit our conceptions. This view of the compoſition of our ideas, repreſenting their conſtituent parts in every ſtep of the progreſſion, naturally points out the true and genuine form of a definition; for as definitions are no more than deſcriptions of the ideas for which the terms defined ſtand; and as ideas are then deſcribed when we enumerate diſtinctly and in order the parts of which they conſiſt, it is plain that, by making our definitions follow one another, according to the natural train of our conceptions, they will be ſubject to the ſame rules, and keep pace with the ideas they deſcribe.

The form of a definition in all the various orders of conception.

X. As therefore the firſt order of our compound notions, or the ideas that conſtitute the higheſt genera in the different ſcales of perception, are formed by uniting together a certain number of ſimple notices, ſo the terms expreſſing theſe genera, are defined *by enumerating the ſimple notices ſo combined.* And as the ſpecies comprehended under any genus, or the complex ideas of the ſecond order, ariſe from ſuperadding the ſpecific difference to the ſaid general idea, ſo the definition of the names of the ſpecies is abſolved *in a detail of the ideas of the ſpecific difference connected with the term of the genus.* For the genus having been before defined, the term by which it is expreſſed ſtands for a known idea, and may therefore be introduced into all ſubſequent definitions, in the ſame manner as the names of ſimple perceptions. It will now I think be ſufficiently obvious, that the definitions of all the ſucceeding orders of compound notions will everywhere conſiſt *of the term of the neareſt genus joined with an enumeration of the ideas that conſtitute the ſpecific difference*; and that the definition of individuals *unites the name of the loweſt ſpecies with the terms by which we expreſs the ideas of the numeric difference.*

The logical method of defining, perfect in its kind,

XI. Here then we have the true and proper form of a definition, in all the various orders of conception. This is that method of defining which is commonly called *logical*, and which we ſee is perfect in its kind, inaſmuch as it preſents a full and adequate deſcription of the idea for which the term defined ſtands. There are ſtill two things worthy of obſervation, before we take leave of this ſubject. Firſt, That the very frame and contexture of theſe definitions points out the order in which they ought to follow one another: for as the name of the genus is admitted into a deſcription, only in conſequence of its having been before defined, it is evident that we muſt paſs gradually through all the different orders of conception. Accordingly, logicians lay it down as a rule, that we are to begin always with the higheſt genus, and carry on the ſeries of definitions regularly thro' all the intermediate genera and ſpecies, quite down to the individuals. By this means our deſcriptions keep pace with our ideas, and paſs through the ſame ſucceſſive gradations; inſomuch, that the peruſal of them muſt excite thoſe ideas in the underſtanding of another, in the very order and manner in which they are put together by the mind, in its uniform advances from ſimple to the moſt complicated notions. Now this is the true and proper end of defining, and indeed the higheſt perfection of that art.

and applicable to all words whatſoever, capable of a definition.

XXII. There is yet another thing to be obſerved on this head, namely; that the form here preſcribed, is applicable to all words whatſoever, capable of a definition; for as every term we uſe muſt denote ſome idea, either general or particular; and as all our complex notions relating to both theſe claſſes of perception, from the higheſt genus quite down to the individuals, come within the rules of deſcription here given, it is evident that this particular manner of unfolding an idea may be extended to all the poſſible complex conceptions we can connect with our words. By the rules therefore of this method, definitions may be applied to aid terms ſtanding for complex ideas; and as theſe, by what we have ſhewn at large in the two foregoing chapters, are the only definable articles of ſpeech, it neceſſarily follows, that the directions here given are univerſal, extend to all particular inſtances, and are alike applicable in all languages. And thus at length, we have not only deduced that peculiar form of a definition which obtains among logicians, but ſhewn it alſo to be perfect in its kind, and to take in the whole compaſs of language.

THE
ELEMENTS OF LOGIC.

BOOK II.

OF JUDGMENT OR INTUITION.

CHAP. I.

Of the Grounds of Human Judgment.

Intuition reſpects the relations between our ideas when they are immediately perceiveable.

I. WHEN the mind is furniſhed with ideas, its next ſtep in the way to knowledge is, the comparing theſe ideas together, in order to judge of their agreement or diſagreement. In this joint view of our ideas, if the relation is ſuch as to be immediately diſcoverable by the bare inſpection of the mind, the judgments thence obtained are called *intuitive*, from a word that denotes *to look at:* for in this caſe, a mere attention to the ideas compared, ſuffices to let us ſee how far they are connected or disjoined. Thus, *that the whole is greater than any of its parts*, is an intuitive judgment, nothing more being required to convince us of its truth than an attention to the ideas of *whole* and *part*. And this too is the reaſon why we call the act of the mind forming theſe judgments, *intuition*; as it is indeed no more than an immediate perception of the agreement or diſagreement of any two ideas.

Experience and teſtimony the ground of judging as to facts.

II. But here it is to be obſerved, that our knowledge of this kind, reſpects only our ideas, and the relations between them, and therefore can ſerve only as a foundation to ſuch reaſonings as are employed in inveſtigating theſe relations. Now it ſo happens, that many of our judgments are converſant about facts and the real exiſtence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, becauſe I have the idea of a circle in my mind, that therefore a figure anſwering to that idea has a real exiſtence in nature. I can form to myſelf the notion of a centaur, or golden mountain, but never imagine on that account that either of them exiſt. What then are the grounds of our judgment in relation to facts?

I anſwer, Theſe two, *experience* and *teſtimony*. By *experience* we are informed of the exiſtence of the ſeveral objects which ſurround us and operate on our ſenſes. *Teſtimony* is of a wider extent, and reaches not only to objects beyond the preſent ſphere of our obſervation, but alſo to facts and tranſactions, which being now paſt, and having no longer any exiſtence, could not without this conveyance have fallen under our cognizance.

Three foundations of human judgment, viz. 1. Intuition, the ground of ſcientifical knowledge.

III. Here then we have three foundations of human judgment, from which the whole ſyſtem of our knowledge may with eaſe and advantage be deduced. 1ſt, *Intuition*, which reſpects our ideas themſelves and their relations, and is the foundation of that ſpecies of reaſoning which we call *demonſtration*: for whatever is deduced from our intuitive preceptions by a clear and connected ſeries of proofs, is ſaid to be demonſtrated, and produces abſolute certainty in the mind. Hence the knowledge obtained in this manner, is what we properly term *ſcience*; becauſe in every ſtep of the procedure it carries its own evidence along with it, and leaves no room for doubt or heſitation: and what is highly worthy of notice, as the truths of this claſs expreſs the relations between our ideas, and the ſame relations muſt ever and invariably ſubſiſt between the ſame ideas, our deductions in the way of ſcience conſtitute what we call eternal, neceſſary, and immutable truths. If it be true that the whole is equal to all its parts, it muſt be ſo unchangeably, becauſe the relations of equality being attached to the ideas themſelves, muſt ever intervene where the ſame ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematics; and in general whatever may be gathered from the bare view and conſideration of our ideas.

2. Experience the ground of our knowledge of the powers and qualities of bodies.

IV. The ſecond ground of human judgment is *experience*; from which we infer the exiſtence of thoſe objects that ſurround us, and fall under the immediate notice of our ſenſes. When we ſee the ſun, or caſt our eyes towards a building, we not only have ideas of theſe objects within ourſelves, but aſcribe to them a real exiſtence out of the mind. It is alſo by the information of the ſenſes that we judge of the qualities of bodies; as when we ſay that ſnow is white, fire hot, or ſteel hard; for as we are wholly unacquainted with the internal ſtructure and conſtitution of the bodies that produce theſe ſenſations in us, nay, and are unable to trace any connection between that ſtructure and the ſenſations themſelves, it is evident that we build our judgments altogether upon obſervation, aſcribing to bodies ſuch qualities as are anſwerable to the perceptions they excite in us. But this is not the only advantage derived from experience, for to that too are we indebted for all our knowledge regarding the co-exiſtence of ſenſible qualities in objects, and the operations of bodies one upon another. Ivory, for inſtance, is hard and elaſtic: this we know by experience, and indeed by that alone; for being altogether ſtrangers to the true nature both of elaſticity and hardneſs, we cannot by the bare contemplation of our ideas determine how far the one neceſſarily implies the other, or whether there may not be a repugnance between them. But when we obſerve them to exiſt both in the ſame object, we are then aſſured from experience, that they are not incompatible; and when we alſo find that a ſtone is hard and not elaſtic, and that air though elaſtic is not hard, we alſo conclude upon the ſame foundation, that the ideas are not neceſſarily conjoined, but may exiſt ſeparately in different objects. In like manner with regard to the operations of bodies one upon another, it is evident that our knowledge this way is all derived from obſervation. *Aqua regia* diſſolves gold, as has been found by frequent trial, nor is there any other way of arriving at the diſcovery. Naturaliſts may tell us, if they pleaſe, that the parts of *aqua regia* are of a texture apt to inſinuate between the corpuſcles of gold, and thereby looſen and ſhake them aſunder. If this is a true account of the matter, I believe it will notwithſtanding be allowed, that our conjecture in regard to the conformation of theſe bodies is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate ſtructure of *aqua regia* and *gold*, and the aptneſs of their parts to act or be acted upon, that we came by the concluſion abovementioned. The internal conſtitution of bodies is in a manner wholly unknown to us; and could we even ſurmount this difficulty, yet as the ſeparation of the parts of gold implies ſomething like an active force in the *menſtruum*, and we are unable to conceive how it comes to be poſſeſſed of this activity, the effect muſt be owned to be altogether beyond our comprehenſion. But when repeated trials had once confirmed it, inſomuch that it was admitted as an eſtabliſhed truth in natural knowledge, it was then eaſy for men to ſpin out theories of their own invention, and contrive ſuch a ſtructure of parts both for *gald* and *aqua regia*, as would beſt ſerve to explain the phenomenon upon the principles of that ſyſtem of philoſophy they had adopted. I might eaſily ſhew, from innumerable other inſtances, how much our knowledge of the mutual action of bodies depends upon obſervation. The bite of a viper will kill; plants are ſome ſalutary, others noxious; fire diſſolves one body, and hardens another. Theſe are truths generally known; nor is it leſs evident that we owe their diſcovery wholly to experience.

Why many uſeful inventions owe their birth to chance.

V. And hence it is eaſy to account for what to ſome writers has appeared a very great paradox; that moſt of the important inventions in human life have taken their riſe from chance, and inſtead of coming out of the ſchools of philoſophers, are for the moſt part aſcribed to men of no figure in the commonwealth of learning. Sowing, planting, the uſe of the compaſs, and ſuch like, are not deductions of human reaſon, but diſcoveries which owe their birth to obſervation and trial. No wonder, therefore, if theſe inventions derived their beginning from ſuch as being engaged in the active and buſy ſcenes of life, were more in the way of thoſe experiments which lead to diſcoveries of this nature. And here, as the particular callings and profeſſions of men, and oftentimes chance, has a great aſcendant, it need not ſeem ſtrange if ſome of the moſt uſeful arts in ſociety appear to have had an original purely caſual.

Natural knowledge from the grounds on which it reſts, aptly termed experimental philoſophy.

VI. From what has been ſaid, it is evident that, as intuition is the foundation of what we call *ſcientifical* knowledge, ſo is experience of *natural*;—for this laſt being wholly taken up with the objects of ſenſe, or thoſe bodies that conſtitute the natural world; and their properties, as far as we can diſcover them, being to be traced only by a long and painful ſeries of obſervations, it is apparent that, in order to improve this branch of knowledge, we muſt betake ourſelves to the method of trial and experiment. Accordingly, we find, that while this was neglected, little advance was made in the philoſophy of nature; whereas a contrary proceeding has enriched the preſent age with many valuable diſcoveries; inſomuch that natural knowledge, in alluſion to the foundation on which it ſtands, has been very aptly called *experimental philoſophy*.

Though much of our knowledge of body depends on teſtimony, yet experience is the ultimate foundation of it.

VII. But though experience is what we may term the immediate foundation of natural knowledge, yet with reſpect to particular perſons, its influence is very narrow and confined. The bodies that ſurround us are numerous, many of them lie at a great diſtance, and ſome quite beyond our reach. Life too is ſhort, and ſo crowded with cares, that but little time is left for any ſingle man to employ himſelf in unfolding the myſteries of nature. Hence it is neceſſary to admit many things upon the teſtimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aqua regia* to diſſolve gold, though perhaps he never himſelf made the experiment. In theſe therefore, and ſuch like caſes, we judge of the facts and operations of nature upon the mere ground of teſtimony. However, as we can always have recourſe to experience where any doubt or ſcruple ariſes, this is juſtly conſidered as the true foundation of natural philoſophy; being indeed the ultimate ſupport upon which our aſſent reſts, and whereto we appeal, when the higheſt degree of evidence is required.

3. Teſtimony the ground of hiſtorical knowledge.

VIII. But there are many facts that will not allow of an appeal to the ſenſes; and in this caſe teſtimony is the true and only foundation of our judgments. All human actions, of whatever kind, when conſidered as already paſt, are of the nature here deſcribed; becauſe having now no longer any exiſtence, both the facts themſelves and the circumſtances attending them, can be known only from the relations of ſuch as had ſufficient opportunities of arriving at the truth. *Teſtimony* therefore is juſtly accounted a third ground of human judgment; and as from the other two we have deduced *ſcientifical* and *natural* knowledge, ſo may we from this derive *hiſtorical*; by which I would be underſtood to mean, not merely a knowledge of the civil tranſactions of ſtates and kingdoms, but of all facts whatſoever, where teſtimony is the ultimate foundation of our belief.

The ſecond operation of the mind commonly extended beyond intuition.

IX. Before I conclude this chapter, it will be neceſſary to obſerve, that tho' the ſecond operation of the mind, properly ſpeaking, extends not beyond intuitive perceptions, yet logicians have not confined themſelves to ſo ſtrict a view of it; but calling it by the name *judgment*, thereby denote all acts of the mind, where only two ideas are compared without the immediate interpoſition of the third; for when the mind joins or ſeparates two ideas, tho' perhaps this is done in conſequence of a train of previous reaſoning, yet if the underſtanding proceeds upon eſtabliſhed notions, without attending to that train of reaſoning, its determinations are ſtill conſidered as acts of judgment. Thus, *that God created the univerſe*, that *men are accountable for their actions*, are frequently mentioned by logicians as inſtances of the mind judging; and yet it is apparent that theſe judgments are by no means of the kind we call intuitive; nay, that it requires much exerciſe of the reaſoning faculty before a man can trace their connection with the perceptions of that name. I could in the ſame manner eaſily ſhew, that even our judgments of experience and teſtimony, when purſued to their ſource, derive all their power of perſuaſion from being linked with intuitive truths. But I ſhall wave this enquiry for the preſent, as being of a nature too ſubtile for a work of this kind. The remark itſelf however was needful, as well to illuſtrate the proper diſtinction between the powers of the underſtanding, as to explain the reaſon, why in this part of logic, we extend the ſecond operation of the mind beyond thoſe limits that, in ſtrictneſs of ſpeech, belong to it. Let us now proceed to conſider a little more particularly the nature and variety of theſe our judgments.

CHAP. II.

Of Affirmative and Negative Propoſitions.

The ſubject and predicate of a propoſition explained.

I. WHILE the comparing of our ideas is conſidered merely as an act of the mind aſſembling them together, and joining or diſjoining them according to the reſult of its perceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propoſitions*. A propoſition therefore is a ſentence expreſſing ſome judgment of the mind, whereby two or more ideas are affirmed to agree or diſagree. Now as our judgments include at leaſt two ideas, one of which is affirmed or denied of the other, ſo muſt a propoſition have terms anſwering to theſe ideas. The idea of which we affirm or deny, and of courſe the term expreſſing that idea, is called the *ſubject* of the propoſition. The idea affirmed or denied, as alſo the term anſwering it, is called the *predicate*. Thus in the propoſition, *God is omnipotent*: *God* is the ſubject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, becauſe we affirm the idea, expreſſed by that word, to belong to God.

The copula, &c.

II. But as in propoſitions ideas are either joined or disjoined, it is not enough to have terms expreſſing thoſe ideas, unleſs we have alſo ſome words to denote their agreement or diſagreement. That word in a propoſition which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby underſtand that the ideas are disjoined. The *ſubſtantive verb* is commonly made uſe of for the copula, as in the above-mentioned propoſition *God is omnipotent*; when it repreſents the copula, and ſignifies the agreement of the ideas of *God* and *omnipotence*. But if we mean to ſeparate two ideas; then, beſides the ſubſtantive verb, we muſt alſo uſe ſome particle of negation to expreſs this repugnance. The propoſition, *man is not perfect*, may ſerve as an example of this kind, where the notion of *perfection* being removed from the idea of *man*, the negative particle *not* is inſerted after the copula, to ſignify the diſagreement between the ſubject and predicate.

Propoſitions ſometimes expreſſed by a ſingle word.

III. Every propoſition neceſſarily conſiſts of theſe three parts, but then it is alike needful that they be all ſeverally expreſſed in words; becauſe the copula is often included in the term of the predicate, as when we ſay *he ſits*; which imports the ſame as *he is ſitting*. In the *Latin* language, a ſingle word has often the force of a whole ſentence. Thus *ambulat* is the ſame as *ille eſt ambulans*; *amo*, as *ego ſum amans*; and ſo in innumerable other inſtances; by which it appears, that we are not ſo much to regard the number of words in a ſentence as the ideas they repreſent, and the manner in which they are put together; for whenever two ideas are joined or disjoined in an expreſſion, though of but a ſingle word, it is evident that we have a ſubject, predicate, and copula, and of conſequence a complete propoſition.

Affirmative and negative propoſitions.

IV. When the mind joins two ideas, we call it an *affirmative* judgment; when it ſeparates them, a *negative*; and as any two ideas compared together, muſt neceſſarily either agree or not agree, it is evident that all our judgments fall under theſe two diviſions. Hence, likewiſe, the propoſitions expreſſing theſe judgments, are all either affirmative or negative. An affirmative propoſition connects the predicate with the ſubject, as *a ſtone is heavy*: a negative propoſition ſeparates them, as *God is not the author of evil.* *Affirmation* therefore is the ſame as joining two ideas together; and this is done by means of the copula. *Negation*, on the contrary, marks a repugnance between the ideas compared; in which caſe a negative particle muſt be called in, to ſhew that the connection included in the copula does not take place.

When the negative particle ſerves to disjoin ideas.

V. And hence we ſee the reaſon of the rule commonly laid down by logicians; that in all negative propoſitions, the negation ought to affect the copula; for as the copula, when placed by itſelf between the ſubject and the predicate, manifeſtly binds them together, it is evident that, in order to render a propoſition negative, the particle of negation muſt enter it in ſuch manner as to deſtroy this union. In a word, then only two ideas are disjoined in a propoſition, when the negative particle may be ſo referred to the copula as to break the affirmation included in it, and undo that connection it would otherwiſe eſtabliſh. When we ſay, for inſtance, *no man is perfect*; take away the negation, and the copula of itſelf plainly unites the ideas in the propoſition. But as this is the very reverſe of what is intended, a negative mark is added, to ſhew that this union does not here take place. The negation, therefore, by deſtroying the effect of the copula, changes the very nature of the propoſition, inſomuch that inſtead of binding two ideas together, it denotes their ſeparation. On the contrary, in this ſentence; *The man who departs not from an upright behaviour, is beloved of God:* the predicate, *beloved of God*, is evidently affirmed of the ſubject, *an upright man*; ſo that notwithſtanding the negative particle, the propoſition is ſtill affirmative. The reaſon is plain; the negation here affects not the copula, but making properly a part of the ſubject, ſerves with other terms in the ſentence to form one complex idea, of which the predicate, *beloved of God*, is directly affirmed. This perhaps to ſome may appear a mere logical refinement, contrived to juſtify the ſcholaſtic rule for diſtinguiſhing between affirmative and negative propoſitions. But if it be conſidered that this diſtinction is of great importance in reaſoning, and cannot in many caſes be made with certainty but by means of this criterion here given, the reader will ſee ſufficient reaſon for my taking ſo much pains to illuſtrate it.

How a copula comes to be part of a negative propoſition.

VI. Perhaps it may ſtill appear a myſtery, how a copula can be ſaid to be a part of a negative propoſition, whoſe proper buſineſs it is to disjoin ideas. This difficulty however will vaniſh, if we call to mind that every judgment implies a direct affirmation, and that this affirmation alone makes the true copula in a propoſition. But as our affirmations are of two kinds, *viz.* either of agreement or of diſagreement, between the ideas compared, hence there is alſo a twofold expreſſion of our judgments. In the caſe of agreement, the copula alone ſuffices, becauſe it is the proper mark whereby we denote an identity or conjunction of ideas; but where perceptions diſagree, there we muſt call in a negative particle; and this gives us to underſtand that the affirmation implied in the copula is not of any connection between the ſubject and predicate, but of their mutual oppoſition and repugnance.

CHAP. III.

Of Univerſal and Particular Propoſitions.

Diviſion of propoſitions into univerſal and particular.

I. THE next conſiderable diviſion of propoſitions, is into *univerſal* and *particular*. Our ideas, according to what has been already obſerved in the firſt part, are all ſingular as they enter the mind, and repreſent individual objects. But as by abſtraction we can render them univerſal, ſo as to comprehend a whole claſs of things, and ſometimes ſeveral claſſes at once, hence the terms expreſſing theſe ideas muſt be in like manner univerſal. If therefore we ſuppoſe any general term to become the ſubject of a propoſition, it is evident that whatever is affirmed of the abſtract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus, when we ſay *men are mortal*, we conſider mortality not as confined to one or any number of particular men, but as what may be affirmed without reſtriction of the whole ſpecies. By this means the propoſition becomes as general as the idea which makes the ſubject of it, and indeed derives its univerſality entirely from that idea, being more or leſs ſo according as this may be extended to more or fewer individuals. But it is further to be obſerved of theſe general terms, that they ſometimes enter a propoſition in their full latitude, as in the example given above; and ſometimes appear with a mark of limitation. In this laſt caſe we are given to underſtand, that the predicate agrees not to the whole univerſal idea, but only to a part of it; as in the propoſition, *Some men are wiſe*; for here wiſdom is not affirmed of every particular man, but reſtrained to a few of the human ſpecies.

Propoſitions univerſal where the ſubject is ſo, without a mark of reſtriction.

II. Now from this different appearance of the general idea, that conſtitutes the ſubject of any judgment, ariſes the diviſion of propoſitions into *univerſal* and *particular*. An *univerſal* propoſition is that wherein the ſubject is ſome general term, taken in its full latitude, inſomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper ſpecies; and to all the ſeveral ſpecies and their individuals, if it marks an idea of a higher order. The words *all*, *every*, *no*, *none*, &c. are the proper ſigns of this univerſality; and as they ſeldom fail to accompany general truths, ſo they are the moſt obvious criterion whereby to diſtinguiſh them. *All animals have a power of beginning motion.* This is an univerſal propoſition, as we know from the word *all* prefixed to the ſubject *animal*, which denotes that it muſt be taken in its full extent. Hence the power of beginning motion may be affirmed of all the ſeveral ſpecies of animals; as of birds, quadrupeds, inſects, fiſhes, &c. and of all the individuals of which theſe different claſſes conſiſt, as of this hawk, that horſe, and ſo for others.

Propoſitions particular where ſome univerſal ſubject appears with a mark of limitation.

III. A particular propoſition has in like manner ſome general term for its ſubject, but with a mark of limitation added, to denote that the predicate agrees only to ſome of the individuals comprehended under a ſpecies, or to one or more of the ſpecies belonging to any genus, and not to the whole univerſal idea. Thus, *ſome ſtones are heavier than iron*; *ſome men have an uncommon ſhare of prudence*. In the laſt of theſe propoſitions, the ſubject *ſome men* implies only a certain number of individuals, comprehended under a ſingle ſpecies. In the former, where the ſubject is a genus, that extends to a great variety of diſtinct claſſes; *ſome ſtones* may not only imply any number of particular ſtones, but alſo ſeveral whole ſpecies of ſtones; inaſmuch as there may be not a few with the property there deſcribed. Hence we ſee that a propoſition does not ceaſe to be particular by the predicate's agreeing to a whole ſpecies, unleſs that ſpecies, ſingly and diſtinctly conſidered, makes alſo the ſubject of which we affirm or deny; for if it belongs to ſome genus that has other ſpecies under it, to which the predicate does not agree, it is plain that where this genus is that of which we affirm or deny, the predicate agreeing only to a part of it, and not to the whole general idea, conſtitutes the propoſition particular.

A ſure and infallible criterion whereby to diſtinguiſh between univerſal and particular propoſitions.

IV. Here then we have a ſure and infallible mark whereby to diſtinguiſh between univerſal and particular propoſitions. Where the predicate agrees to all the individuals comprehended under the notion of the ſubject, there the propoſition is univerſal; where it belongs only to ſome of them, or to ſome of the ſpecies of the general idea, there the propoſition is particular. This criterion is of eaſy application, and much ſafer than to depend upon the common ſigns of *all*, *every*, *ſome*, *none*, &c. becauſe theſe being different in different languages, and often varying in their ſignification, are very apt in many caſes to miſlead the judgment. Thus, if we ſay *all the ſoldiers when drawn up, formed a ſquare of an hundred men a ſide*, it is evident that the predicate cannot be affirmed of the ſeveral individuals, but of the whole collective idea of the ſubject; whence by the rule given above, the propoſition is not univerſal. It is true, logicians lay down many obſervations, to enable us to diſtinguiſh aright on this head; but if the criterion here given be duly attended to, it will be of more real ſervice to us than an hundred rules; for it is infallible, and may be applied with eaſe; whereas the directions which we meet with in treatiſes of logic, being drawn for the moſt part from the analogy of language and common forms of ſpeech, are not only burdenſome to the memory, but often very doubtful and uncertain in their application.

Singular propoſitions contained under the head of particulars.

V. There is ſtill one ſpecies of propoſitions that remains to be deſcribed; and which the more deſerves our notice, as it is not yet agreed among logicians, to which of the two claſſes mentioned above they ought to be referred. I mean ſingular propoſitions, or thoſe where the ſubject is an individual. Of this nature are the following: *Sir Iſaac Newton was the inventor of fluxions: this book contains many uſeful truths.* — What occaſions ſome difficulty, as to the proper rank of theſe propoſitions, is, that the ſubject being taken according to the whole of its extenſion, they ſometimes have the ſame effect in reaſoning as univerſals: but if it be conſidered, that they are in truth the moſt limited kind of particular propoſitions, and that no propoſition can with any propriety be called univerſal but where the ſubject is ſome univerſal idea, we ſhall not long be in determining to which claſs they ought to be referred. When we ſay *ſome books contain uſeful truths*, the propoſition is particular, becauſe the general term appears with a mark of reſtriction. If therefore we ſay *this book contains uſeful truths*, it is evident that the propoſition muſt be ſtill more particular, as the limitation implied in the word *this*, is of a more confined nature than in the former caſe. I know there are inſtances where ſingular propoſitions have the ſame effect in reaſoning as univerſals; yet this is not by reaſon of any proper univerſality belonging to them, but becauſe the concluſion in ſuch caſes being always ſingular, may be proved by a middle term which is alſo ſingular; as I could eaſily demonſtrate, were this a proper place for entering into a diſcuſſion of that nature.

The fourfold diviſion of propoſitions.

VI. We ſee therefore, that all propoſitions are either affirmative or negative; nor is it leſs evident that in both caſes they may be univerſal or particular. Hence ariſes that celebrated fourfold diviſion of them into univerſal affirmative and univerſal negative, particular affirmative and particular negative; which comprehends indeed all their varieties. The uſe of this method of diſtinguiſhing them will appear more fully afterwards, when we come to treat of reaſoning and ſyllogiſm.

CHAP. IV.

Of Abſolute and Conditional Propoſitions.

Diſtinction of qualities into eſſential and accidental.

I. THE objects about which we are chiefly converſant in this world, are all of a nature liable to change. What may be affirmed of them at one time, cannot often at another; and it makes no ſmall part of our knowledge to diſtinguiſh rightly theſe variations, and trace the reaſons upon which they depend. For it is obſervable, that amidſt all the viciſſitudes of nature, ſome things remain conſtant and invariable; nor are even the changes to which we ſee others liable, effected but in conſequence of uniform and ſteady laws, which when known, are ſufficient to direct us in our judgments about them. Hence philoſophers, in diſtinguiſhing the objects of our perception into various claſſes, have been very careful to note, that ſome properties belong eſſentially to the general idea, ſo as not to be ſeparable from it but by deſtroying its very nature; while others are only accidental, and may be affirmed or denied of it, in different circumſtances. Thus, ſolidity, a yellow colour, and great weight, are conſidered as eſſential qualities of gold; but whether it ſhall exiſt as an uniform conjoined maſs, is not alike neceſſary. We ſee that by a proper menſtruum, it may be reduced to a fine powder; and that intenſe heat will bring it into a ſtate of fuſion.

Hence a conſiderable diverſity in our manner of judging.

II. Now from this diverſity in the ſeveral qualities of things, ariſes a conſiderable difference as to the manner of our judging about them; for, in the firſt place, All ſuch properties are as inſeparable from objects, when conſidered as belonging to any genus or ſpecies, are affirmed abſolutely and without reſerve of that general idea. Thus, we ſay *gold is very weighty, a ſtone is hard, animals have a power of ſelf-motion.* But in the caſe of mutable or accidental qualities, as they depend upon ſome other conſideration, diſtinct from the general idea, that alſo muſt be taken into the account, in order to form an accurate judgment. Should we affirm, for inſtance, of ſome ſtones, that they are very ſuſceptible of a rolling motion, the propoſition, while it remains in this general form, cannot with any advantage be introduced into our reaſonings. An aptneſs to receive that mode of motion flows from the figure of the ſtone; which, as it may vary infinitely, our judgment then only becomes applicable and determinate when the particular figure, of which volubility is a conſequence, is alſo taken into the account. Let us then bring in this other conſideration, and the propoſition will run as follows: *ſtones of a ſpherical form are eaſily put into a rolling motion.* Here we ſee the condition upon which the predicate is affirmed, and therefore know in what particular caſes the propoſition may be applied.

Which gives riſe to the diviſion of propoſitions into abſolute and conditional.

III. This conſideration of propoſitions, reſpecting the manner in which the predicate is affirmed of the ſubject, gives riſe to the diviſion of them into *abſolute* and *conditional.* *Abſolute* propoſitions are thoſe wherein we affirm ſome property inſeparable from the idea of the ſubject, and which therefore belongs to it in all poſſible caſes; as, *God is infinitely wiſe: virtue tends to the ultimate happineſs of man.* But where the predicate is not neceſſarily connected with the idea of the ſubject, unleſs upon ſome conſideration diſtinct from that idea, there the propoſition is called *conditional.* The reaſon of the name is taken from the ſuppoſition annexed, which is of the nature of a condition, and may be expreſſed as ſuch: thus, *If a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat. If a river runs in a very declining channel, its rapidity will conſtantly increaſe.*

The great importance of this diviſion, as it renders

IV. There is not any thing of greater importance in philoſophy than a due attention to this diviſion of propoſitions. If we are care-propoſitions determinate, ful never to affirm things abſolutely, but where the ideas are inſeparably conjoined; and if in our other judgments we diſtinctly mark the conditions which determine the predicate to belong to the ſubject, we ſhall be the leſs liable to miſtake in applying general truths to the particular concerns of human life. It is owing to the exact obſervance of this rule that mathematicians have been ſo happy in their diſcoveries; and that what they demonſtrate of magnitude in general, may be applied with eaſe in all obvious occurrences.

and reduces them from particulars to generals.

V. The truth of it is, particular propoſitions are then known to be true when we can trace their connection with univerſals; and it is accordingly the great buſineſs of ſcience to find out general truths, that may be applied with ſafety in all obvious inſtances. Now the great advantage ariſing from determining with care the conditions upon which one idea may be affirmed or denied of another, is this, that thereby particular propoſitions really become univerſal, may be introduced with certainty into our reaſonings, and ſerve as ſtandards to conduct and regulate our judgments. To illuſtrate this by a familiar inſtance: if we ſay, *ſome water acts very forcibly*, the propoſition is particular; and as the conditions on which this forcible action depends are not mentioned, it is as yet uncertain in what caſes it may be applied. Let us then ſupply theſe conditions, and the propoſition will run thus; *water conveyed in ſufficient quantity along a ſteep deſcent, acts very forcibly.* Here we have an univerſal judgment, inaſmuch as the predicate *forcible action*, may be aſcribed to all water under the circumſtances mentioned. Nor is it leſs evident that the propoſition in this new form is of eaſy application; and in fact we find, that men do apply it in inſtances where the forcible action of water is required; as in corn-mills, and many other works of art. Thus we ſee in what manner we are to proceed, in order to arrive at univerſal truths, which is the great end and aim of ſcience. And indeed, would men take the ſame care duly to expreſs the conditions on which they affirm and deny, as mathematicians do, in thoſe theorems which they term hypothetical, I doubt not but we might be able to deduce many truths in other parts of philoſophy with no leſs clearneſs, force, and perſpicuity, than has hitherto been thought peculiar to the ſcience of quantity.

CHAP. V.

Of Simple and Compound Propoſitions.

Diviſion of propoſitions into ſimple and compound.

I. HITHERTO we have treated of propoſitions where only two ideas are compared together. Theſe are in the general called *ſimple*; becauſe having but one ſubject and one predicate, they are the effect of a ſimple judgment that admits of no ſubdiviſion. But if it ſo happens that ſeveral ideas offer themſelves to our thoughts at once, whereby we are led to affirm the ſame thing of different objects, or different things of the ſame object, the propoſitions expreſſing theſe judgments are called *compound*; becauſe they may be reſolved into as many others as there are ſubjects or predicates in the whole complex determination of the mind. Thus, *God is infinitely wiſe, and infinitely powerful.* Here there are two predicates, *infinite wiſdom and infinite power*, both affirmed of the ſame ſubject; and accordingly the propoſition may be reſolved into two others, affirming theſe predicates ſeverally. In like manner in the propoſition, *neither kings nor people are exempt from death*, the predicate is denied of both ſubjects, and may therefore be ſeparated from them in diſtinct propoſitions. Nor is it leſs evident that if a complex judgment conſiſts of ſeveral ſubjects and predicates, it may be reſolved into as many ſimple propoſitions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind and increaſe the number of our deſires.* In this judgment there are two ſubjects and two predicates, and it is at the ſame time apparent that it may be reſolved into four diſtinct propoſitions. *Riches are apt to elate the mind. Riches are apt to increaſe the number of our deſires.* And ſo of honours.

The proper notion of a compound propoſition aſcertained.

II. Logicians have divided theſe compound propoſitions into a great many different claſſes; but, in my opinion, not with a due regard to their proper definition. Thus *conditionals, cauſals, relatives,* &c. are mentioned as ſo many diſtinct ſpecies of this kind, though in fact they are no more than ſimple propoſitions. To give an inſtance of a conditional: *if a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat.* Here we have but one ſubject and one predicate; for the complex expreſſion, *a ſtone expoſed to the rays of the ſun,* conſtitutes the proper ſubject of this propoſition, and is no more than one determinate idea. The ſame thing happens in cauſals. *Rehoboam was unhappy, becauſe he followed evil counſel.* I deny not that there is here an appearance of two propoſitions ariſing from the complexity of the expreſſion; but when we come to conſider the matter more nearly, it is evident that we have but a ſingle ſubject and predicate. *The purſuit of evil counſel brought miſery upon Rehoboam.* It is not enough therefore to render a propoſition compound, that the ſubject and predicate are complex notions, requiring ſometimes a whole ſentence to expreſs them; for in this caſe the compariſon is ſtill confined to two ideas, and conſtitutes what we call a ſimple judgment. But where there are ſeveral ſubjects or predicates, or both, as the affirmation or negation may be alike extended to them all, the propoſition expreſſing ſuch a judgment is truly a collection of as many ſimple ones as there are different ideas compared. Confining ourſelves therefore to this more ſtrict and juſt notion of compound propoſitions, they are all reducible to two kinds, *viz. copulatives* and *disjunctives*.

Compound propoſitions either copulatives,

III. A *copulative* propoſition is, where the ſubjects and predicates are ſo linked together, that they may be all ſeverally affirmed or denied one of another. Of this nature are the examples of compound propoſitions given above. *Riches and honours are apt to elate the mind, and increaſe the number of our deſires. Neither kings nor people are exempt from death.* In the firſt of theſe, the two predicates may be affirmed ſeverally of each ſubject, whence we have four diſtinct propoſitions. The other furniſhes an example of the negative kind, where the ſame predicate being disjoined from both ſubjects, may be alſo denied of them in ſeparate propoſitions.

or disjunctive.

IV. The other ſpecies of compound propoſitions are thoſe called disjunctives; in which, comparing ſeveral predicates with the ſame ſubject, we affirm that one of them neceſſarily belongs to it, but leave the particular predicate undetermined. If any one, for example, ſays *this world either exiſts of itſelf, or is the work of ſome all-wiſe and powerful cauſe*, it is evident that one of the two predicates muſt belong to the world; but as the propoſition determines not which, it is therefore of the kind we call *disjunctive*. Such too are the following: *The ſun either moves round the earth, or is the center about which the earth revolves. Friendſhip finds men equal, or makes them ſo.* It is the nature of all propoſitions of this claſs, ſuppoſing them to be exact in point of form, that upon determining the particular predicate, the reſt are of courſe to be removed; or if all the predicates but one are removed, that one neceſſarily takes place. Thus, in the example given above, if we allow the world to be the work of ſome wiſe and powerful cauſe, we of courſe deny it to be ſelf-exiſtent; or if we deny it to be ſelf-exiſtent, we muſt neceſſarily admit that it was produced by ſome wiſe and powerful cauſe. Now this particular manner of linking the predicates together, ſo that the eſtabliſhing one diſplaces all the reſt, or the excluding all but one neceſſarily eſtabliſhes that one, cannot otherwiſe be effected than by means of *disjunctive* particles. And hence it is that propoſitions of this claſs take their names from theſe particles which make ſo neceſſary a part of them, and indeed conſtitute their very nature, conſidered as a diſtinct ſpecies. But I ſhall reſerve what farther might be ſaid on this head till I come to treat of reaſoning, where the great uſe and importance of disjunctive propoſitions will better appear.

CHAP. VI.

Of the Diviſion of Propoſitions into Self-evident and demonſtrable.

Deſign of this chapter.

I. AS we are ſoon to enter upon the third part of logic, which treats of reaſoning, and as the art of reaſoning lies in deducing propoſitions whoſe truth does not immediately appear from others more known, it will be proper before we proceed any farther, to examine a little the different degrees of evidence that accompany our judgments; that we may be the better able to diſtinguiſh in what caſes we ought to have recourſe to reaſoning, and what thoſe propoſitions are, upon which, as a ſure and unerring foundation, we may venture to build the truth of others.

Propoſitions divided into ſelf-evident and demonſtrable.

II. When any propoſition is offered to the view of the mind, if the terms in which it is expreſſed are underſtood, upon comparing the ideas together, the agreement or diſagreement aſſerted is either immediately perceived, or found to lie beyond the preſent reach of the underſtanding. In the firſt caſe the propoſition is ſaid to be *ſelf-evident*, and admits not of any proof, becauſe a bare attention to the ideas themſelves produces full conviction and certainty; nor is it poſſible to call in any thing more evident, by way of confirmation. But where the connection or repugnance comes not ſo readily under the inſpection of the mind, there we muſt have recourſe to reaſoning; and if by a clear ſeries of proofs we can make out the truth propoſed, inſomuch that ſelf-evidence ſhall accompany every ſtep of the procedure, we are then able to demonſtrate what we aſſert, and the propoſition itſelf is ſaid to be *demonſtrable*. When we affirm, for inſtance, *that it is impoſſible for the ſame thing to be and not to be*; whoever underſtands the terms made uſe of, perceives at firſt glance the truth of what is aſſerted; nor can he by any efforts bring himſelf to believe the contrary. The propoſition therefore is *ſelf-evident*, and ſuch, that it is impoſſible by reaſoning to make it plainer; becauſe there is no truth more obvious, or better known, from which as a conſequence it may be deduced. But, if we ſay *this world had a beginning*, the aſſertion is indeed equally true, but ſhines not forth with the ſame degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing; and are not brought to a free and full conſent, until by reaſoning we arrive at a clear view of the abſurdity involved in the contrary ſuppoſition. Hence this propoſition is of the kind we call *demonſtrable*, inaſmuch as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable conſequence.

Why the ſecond operation of the mind is confined wholly to intuition.

III. From what has been ſaid, it appears that reaſoning is employed only about demonſtrable propoſitions, and that our intuitive and ſelf-evident perceptions are the ultimate foundation on which it reſts. And now we ſee clearly the reaſon why, in the diſtinction of the powers of the underſtanding, as explained in the introduction to this treatiſe, the ſecond operation of the mind was confined wholly to *intuitive* acts. Our firſt ſtep in the way to knowledge, is to furniſh ourſelves with ideas. When theſe are obtained, we next ſet ourſelves to compare them together, in order to judge of their agreement or diſagreement. If the relations we are in queſt of lie immediately open to the view of the mind, the judgments expreſſing them are ſelf-evident; and the act of the mind forming theſe judgments is what we call *intuition*. But, if upon comparing our ideas together, we cannot readily and at once trace their relation, it then becomes neceſſary to employ ſearch and examination, and call in the aſſiſtance of ſelf-evident truths, which is what we properly term *reaſoning*. Every judgment therefore that is not intuitive, being gained by an exerciſe of the reaſoning faculty, neceſſarily belongs to the third operation of the mind, and ought to be referred to it in a juſt diviſion of the powers of the underſtanding; and indeed it is with this view chiefly that we have diſtinguiſhed propoſitions into ſelf-evident and demonſtrable. Under the firſt head are comprehended all our intuitive judgments; that is, all belonging to the ſecond operation of the mind. Demonſtrable propoſitions are the proper province of the reaſoning faculty, and conſtitute by far the moſt conſiderable part of human knowledge. Indeed, *reaſon* extends alſo to matters of experience and teſtimony, where the proofs adduced are not of the kind called Demonſtration. But I am here only conſidering the powers of the mind as employed in tracing the relations between its own ideas, in which view of things every true propoſition is demonſtrable; tho' very often we find ourſelves incapable of diſcovering and applying thoſe intermediate ideas upon which the demonſtration depends.

Self-evident truths the firſt principles of reaſoning.

IV. Demonſtrable propoſitions therefore, belonging properly to the third operation of the mind, I ſhall for the preſent diſmiſs them, and return to the conſideration of ſelf-evident truths. Theſe, as I have already obſerved, furniſh the firſt principles of reaſoning; and it is certain, that if in our reſearches, we employ only ſuch principles as have this character of ſelf-evidence, and apply them according to the rules to be afterwards explained, we ſhall be in no danger of error, in advancing from one diſcovery to another. For this I may appeal to the writings of the mathematicians, which being conducted by the expreſs model here mentioned, are an inconteſtible proof of the firmneſs and ſtability of human knowledge, when built upon ſo ſure a foundation; for not only have the propoſitions of this ſcience ſtood the teſt of ages, but are found attended with that invincible evidence, as forces the aſſent of all who duly conſider the proofs upon which they are eſtabliſhed. Since then mathematicians are univerſally allowed to have hit upon the right method of arriving at truths; ſince they have been the happieſt in the choice, as well as application of their principles, it may not be amiſs to explain here the diviſion they have given of ſelf-evident propoſitions; that by treading in their ſteps, we may learn ſomething of that juſtneſs and ſolidity of reaſoning for which they are ſo deſervedly eſteemed.

Definitions a great help to clearneſs and evidence in knowledge.

V. Firſt then, it is to be obſerved, that they have been very careful in aſcertaining their ideas, and fixing the ſignification of their terms. For this purpoſe they begin with *definitions*, in which the meaning of their words is ſo diſtinctly explained, that they cannot fail to excite in the mind of an attentive reader the very ſame ideas as are annexed to them by the writer. And indeed I am apt to think that the clearneſs and irreſiſtible evidence of mathematical knowledge, is owing to nothing ſo much as this care in laying the foundation. Where the relation between any two ideas is accurately and juſtly traced, it will not be difficult for another to comprehend that relation, if in ſetting himſelf to diſcover it, he brings the very ſame ideas into compariſon. But if, on the contrary, he affixes to his words ideas different from thoſe that were in the mind of him who firſt advanced the demonſtration, it is evident that, as the ſame ideas are not compared, the ſame relation cannot ſubſiſt; inſomuch that a propoſition will be rejected as falſe, which, had the terms been rightly underſtood, muſt have appeared unexceptionably true. A ſquare, for inſtance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles makes no leſs a part of the idea than the equality of the ſides; and many properties demonſtrated of the ſquare, flow from its being a rectangular figure. If therefore we ſuppoſe a man who has formed a partial notion of a ſquare, comprehending only the equality of its ſides, without regard to the angles, reading ſome demonſtration that implies alſo this latter conſideration, it is plain he would reject it as not univerſally true, inaſmuch as it could not be applied where the ſides were joined together at unequal angles. For this laſt figure anſwering ſtill to this idea of a ſquare, would be yet found without the property aſſigned to it in the propoſition. But if he comes afterwards to correct his notion, and render his idea complete, he will then readily own the truth and juſtneſs of the demonſtration.

Mathematicians, by beginning with them, procure a ready reception to the truths they advance.

VI. We ſee therefore, that nothing contributes ſo much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them ſteady and invariable in all our diſcourſes and reaſonings about them. And on this account it is that mathematicians, as was before obſerved, always begin by defining their terms, and diſtinctly unfolding the notions they are intended to expreſs. Hence ſuch as apply themſelves to theſe ſtudies, having exactly the ſame views of things, and bringing always the very ſame ideas into compariſon, readily diſcern the relations between them, when clearly and diſtinctly repreſented. Nor is there any more natural and obvious reaſon for the univerſal reception given to mathematical truths, and for that harmony and correſpondence of ſentiments which makes the diſtinguiſhing character of the *literati* of this claſs.

The eſtabliſhing of principles the ſecond ſtep in mathematical knowledge.

VII. When they have taken this firſt ſtep, and made known the ideas whoſe relations they intend to inveſtigate, their next care is to lay down ſome ſelf-evident truths, which may ſerve as a foundation for their future reaſonings. And here indeed they proceed with remarkable circumſpection, admitting no principles but what flow immediately from their definitions, and neceſſarily force themſelves upon a mind in any degree attentive to its perceptions. Thus a *circle* is a figure formed by a right line, moving round ſome fixed point in the ſame plane. The fixed point round which the line is ſuppoſed to move, and where one of its extremities terminates, is called the *center* of the circle. The other extremity, which is conceived to be carried round, until it returns to the point whence it firſt ſet out, deſcribes a curve running into itſelf, and termed the *circumference.* All right lines drawn from the center to the circumference are called *radii.* From theſe definitions compared, geometricians derive this ſelf-evident truth, *that the radii of the ſame circle are all equal one to another.* I call it ſelf-evident, becauſe nothing more is required to lay it open to the immediate perception of the mind, than an attention to the ideas compared; for from the very geneſis of a circle, it is plain that the circumference is everywhere diſtant from the center, by the exact length of the deſcribing line; and that the ſeveral radii are in truth nothing more than one and the ſame line variouſly poſited within the figure. This ſhort deſcription will, I hope, ſerve to give ſome little inſight into the manner of deducing mathematical principles, as well as into the nature of that evidence which accompanies them.

Propoſitions divided into ſpeculative and practical.

VIII. And now I proceed to obſerve, that in all propoſitions we either affirm or deny ſome property of the idea that conſtitutes the ſubject of our judgment, or we maintain that ſomething may be done or effected. The firſt ſort are called *ſpeculative* propoſitions, as in the example mentioned above, *the radii of the ſame circle are all equal one to another.* The others are called *practical*, for a reaſon too obvious to be mentioned: thus, *that a right line may be drawn from one point to another*, is a practical propoſition, inaſmuch as it expreſſes that ſomething may be done.

Hence mathematical principles diſtinguiſhed into axioms and poſtulates;

IX. From this twofold conſideration of propoſitions ariſes the twofold diviſion of mathematical principles into *axioms* and *poſtulates*. By an *axiom* they underſtand any ſelf-evident *ſpeculative* truth: as, *that the whole is greater than its parts: that things equal to one* *and the ſame thing, are equal to one another.* But a ſelf-evident *practical* propoſition is what they call a *poſtulate*. Such are thoſe of *Euclid*; *that a finite right line may be continued directly forwards*; *that a circle may be deſcribed about any center with any diſtance.* And here we are to obſerve, that as in an *axiom*, the agreement or diſagreement between the ſubject and predicate muſt come under the immediate inſpection of the mind; ſo in a *poſtulate*, not only the poſſibility of the thing aſſerted muſt be evident at firſt view, but alſo the manner in which it may be effected. But where this manner is not of itſelf apparent, the propoſition comes under the notion of the demonſtrable kind, and is treated as ſuch by the geometrical writers. Thus, *to draw a right line from one point to another*, is aſſumed by *Euclid* as a *poſtulate*, becauſe the manner of doing it is ſo obvious as to require no previous teaching. But then it is not equally evident *how we are to conſtruct an equilateral triangle.* For this reaſon he advances it as a demonſtrable propoſition, lays down rules for the exact performance, and at the ſame time proves that if theſe rules are followed, the figure will be juſtly deſcribed.

and demonſtrable propoſitions into theorems and problems.

X. This naturally leads me to take notice, that as *ſelf-evident truths* are diſtinguiſhed into different kinds, according as they are ſpeculative or practical, ſo it is alſo with *demonſtrable* propoſitions. A demonſtrable ſpeculative propoſition, is by mathematicians called a *theorem.* Such is the famous 47th propoſition of the firſt Book of the *Elements*, known by the name of the *Pythagoric* Theorem, from its ſuppoſed inventor *Pythagoras*, *viz. That in every right-angled triangle the ſquare deſcribed upon the ſide ſubtending the right angle, is equal to both the ſquares deſcribed upon the ſides containing the right angle.* On the other hand, a demonſtrable practical propoſition is called a *problem*; as where *Euclid* teaches us *to deſcribe a ſquare upon a given right line.*

Corollaries are obvious deductions from theorems or problems.

XI. Since I am upon this ſubject, it may not be amiſs to add, that beſides the four kinds of propoſitions already mentioned, mathematicians have alſo a fifth, known by the name of *Corollaries.* Theſe are uſually ſubjoined to *theorems* or *problems*, and differ from them only in this, that they flow from what is there demonſtrated, in ſo obvious a manner as to diſcover their dependence upon the propoſition whence they are deduced, almoſt as ſoon as propoſed. Thus *Euclid*, having demonſtrated *that in every right-lined triangle all the three angles taken together are equal to two right angles*, adds by way of corollary, *that all the three* *angles of any one triangle taken together, are equal to all the three angles of any other triangle taken together*; which is evident at firſt ſight; becauſe in all caſes they are equal to two right ones, and things equal to one and the ſame thing, are equal to one another.

Scholia ſerve the purpoſes of annotations or a comment.

XII. The laſt thing I ſhall take notice of in the practice of the mathematicians, is what they call their *ſcholia*. They are indifferently annexed to definitions, propoſitions, or corollaries; and anſwer the ſame purpoſes as annotations upon a claſſical author. For in them occaſion is taken to explain whatever may appear intricate and obſcure in a train of reaſoning; to anſwer objections; to teach the application and uſes of propoſitions; to lay open the original and hiſtory of the ſeveral diſcoveries made in the ſcience; and, in a word, to acquaint us with all ſuch particulars as deſerve to be known, whether conſidered as points of curioſity or profit.

This method of the mathematicians univerſal, and a ſure guide to certainty.

XIII. Thus we have taken a ſhort view of the ſo much celebrated method of the mathematicians; which to any one who conſiders it with a proper attention, muſt needs appear univerſal and equally applicable in other ſciences. They begin with definitions. From theſe they deduce their axioms and poſtulates, which ſerve as principles of reaſoning; and having thus laid a firm foundation, advance to theorems and problems, eſtabliſhing all by the ſtricteſt rules of demonſtration. The corollaries flow naturally and of themſelves: and if any particulars are ſtill wanting to illuſtrate a ſubject, or complete the reader's information, theſe, that the ſeries of reaſoning may not be interrupted or broken, are generally thrown into ſcholia. In a ſyſtem of knowledge ſo uniform and well connected, no wonder if we meet with certainty; and if thoſe clouds and darkneſſes that deface other parts of human ſcience, and bring diſcredit even upon reaſon itſelf, are here ſcattered and diſappear.

Self evident truths known by the apparent unavoidable connection between the ſubject and predicate.

XIV. But I ſhall for the preſent wave theſe reflections, which every reader of underſtanding is able to make of himſelf, and return to the conſideration of ſelf-evident propoſitions. It will doubtleſs be expected, after what has been here ſaid of them, that I ſhould eſtabliſh ſome *criteria*, or marks, by which they may be diſtinguiſhed. But I frankly own my inability in this reſpect, as not being able to conceive any thing in them more obvious and ſtriking than that ſelf-evidence which conſtitutes their very nature. All I have therefore to obſerve on this head is, that we ought to make it our firſt care to obtain clear and determinate ideas. When afterwards we come to compare theſe together, if we perceive between any of them a neceſſary and unavoidable connection, inſomuch that it is impoſſible to conceive them exiſting aſunder, without deſtroying the very ideas compared, we may then conclude, that the propoſition expreſſing this relation is a principle, and of the kind we call Self-evident. In the example mentioned above *the radii of the ſame circle are all equal between themſelves*, this intuitive evidence ſhines forth in the cleareſt manner; it being impoſſible for any one who attends to his own ideas, not to perceive the equality here aſſerted. For as the circumference is everywhere diſtant from the center by the exact length of the deſcribing line, the radii drawn from the center to the circumference, being ſeverally equal to this one line, muſt needs alſo be equal among themſelves. If we ſuppoſe the radii unequal, we at the ſame time ſuppoſe the circumference more diſtant from the center in ſome places than in others; from which ſuppoſition, as it would exhibit a figure quite different from a circle, we ſee there is no ſeparating the predicate from the ſubject in this propoſition, without deſtroying the idea in relation to which the compariſon was made. The ſame thing will be found to hold in all our other intuitive perceptions, inſomuch that we may eſtabliſh this as an univerſal *criterion* whereby to judge of and diſtinguiſh them. I would not, however, be underſtood to mean, as if this ready view of the unavoidable connection between ſome ideas was any thing really different from ſelf-evidence. It is, indeed, nothing more than the notion of ſelf-evidence a little unfolded, and as it were laid open to the inſpection of the mind. Intuitive judgments need no other diſtinguiſhing marks, than that brightneſs which ſurrounds them; in like manner as light diſcovers itſelf by its own preſence, and the ſplendor it univerſally diffuſes. But I have ſaid enough of ſelf-evident propoſitions, and ſhall therefore now proceed to thoſe of the demonſtrable kind; which being gained in conſequence of reaſoning, naturally leads us to the third part of logic, where this operation of the underſtanding is explained.

THE

ELEMENTS OF LOGIC.

BOOK III.

OF REASONING.

CHAP. I.

Of Reaſoning in general, and the Parts of which it conſiſts.

Remote relations diſcovered by means of intermediate ideas.

I. WE have ſeen how the mind proceeds in furniſhing itſelf with ideas, and framing intuitive perceptions. Let us next enquire into the manner of diſcovering thoſe more remote relations, which, lying at a diſtance from the underſtanding, are not to be traced but by means of a higher exerciſe of its powers. It often happens in comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application one to another. When, for inſtance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain that by barely conſidering the figures themſelves, we cannot arrive at an exact determination; becauſe by reaſon of their diſagreeing forms, it is impoſſible ſo to put them together, as that their ſeveral parts ſhall mutually coincide. Here then it becomes neceſſary to look out for ſome third idea that will admit of ſuch an application as the preſent caſe requires, wherein, if we ſucceed, all difficulties vaniſh, and the relation we are in queſt of may be traced with eaſe. Thus, right-lined figures are all reducible to ſquares, by means of which we can meaſure their areas, and determine exactly their agreement or diſagreement in point of magnitude.

This manner of arriving at truth termed reaſoning.

II. If now it be aſked, how any third idea can ſerve to diſcover a relation between two others? I anſwer, By being compared ſeverally with theſe others; for ſuch a compariſon enables us to ſee how far the ideas with which this third is compared, are connected or disjoined between themſelves. In the example mentioned above of two right-lined figures, if we compare each of them with ſome ſquare whoſe area is known, and find the one exactly equal to it and the other leſs by a ſquare inch, we immediately conclude that the area of the firſt figure is a ſquare inch greater than that of the ſecond. This manner of determining the relation between any two ideas, by the invention of ſome third with which they may be compared, is that which we call *reaſoning*; and indeed the chief inſtrument by which we puſh on our diſcoveries and enlarge our knowledge. The great art lies in finding out ſuch intermediate ideas as when compared with the others in the queſtion, will furniſh evident and known truths; becauſe, as will afterwards appear, it is only by means of them that we arrive at the knowledge of what is hidden and remote.

The parts that conſtitute an act of reaſoning and a ſyllogiſm.

III. From what has been ſaid, it appears that every act of reaſoning neceſſarily includes three diſtinct judgments; two wherein the ideas whoſe relation we want to diſcover, are ſeverally compared with the middle idea; and a third, wherein they are themſelves connected or disjoined according to the reſult of that compariſon. Now, as in the Second Part of Logic, our judgments when put into words were called propoſitions, ſo here, in the Third Part, the expreſſions of our reaſonings are termed *ſyllogiſms*. And hence it follows, that as every act of reaſoning implies three ſeveral judgments, ſo every ſyllogiſm muſt include three diſtinct propoſitions. When a reaſoning is thus put into words and appears in form of a ſyllogiſm, the intermediate idea made uſe of to diſcover the agreement or diſagreement we ſearch for, is called the *middle term*; and the two ideas themſelves with which this third is compared, go by the name of the *extremes*.

Inſtance, man, and accountableneſs.

IV. But as theſe things are beſt illuſtrated by examples, let us, for inſtance, ſet ourſelves to inquire, *whether men are accountable for their actions?* As the relation between the ideas of *man* and *accountableneſs* comes not within the immediate view of the mind, our firſt care muſt be to find out ſome third idea that will enable us the more eaſily to diſcover and trace it. A very ſmall meaſure of reflection is ſufficient to inform us that no creature can be accountable for his actions, unleſs we ſuppoſe him capable of diſtinguiſhing the good from the bad; that is, unleſs we ſuppoſe him poſſeſſed of reaſon. Nor is this alone ſufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and purſue the other? Hence it becomes neceſſary to take in both conſiderations in the preſent caſe. It is at the ſame time equally apparent, that wherever there is this ability of diſtinguiſhing good from bad actions, and purſuing the one and avoiding the other, there alſo a creature is accountable. We have then got a third idea, with which *accountableneſs* is inſeparably connected, *viz. reaſon and liberty*; which are here to be conſidered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the queſtion, *viz. man*, and we all know by experience that it may be affirmed of him. Having thus by means of the intermediate idea formed two ſeveral judgments, *viz. that man is poſſeſſed of reaſon and liberty*; and *that reaſon and liberty imply accountableneſs*; a third obviouſly and neceſſarily follows, *viz. that man is accountable for his actions.* Here then we have a complete act of reaſoning, in which, according to what has been already obſerved, there are three diſtinct judgments; two that may be ſtyled previous, inaſmuch as they lead to the other, and ariſe from comparing the middle idea with the two ideas in the queſtion; the third is a conſequence of theſe previous acts, and flows from combining the extreme ideas between themſelves. If now we put this reaſoning into words, it exhibits what logicians term a ſyllogiſm, and when propoſed in due form, runs thus:

Every creature poſſeſſed of reaſon and liberty is accountable for his actions.

Man is a creature poſſeſſed of reaſon and li-

berty ; therefore man is accountable for his actions.

Premiſes, concluſion, extremes, middle term.

V. In this ſyllogiſm we may obſerve, that there are three ſeveral propoſitions, expreſſing the three judgments implied in the act of reaſoning, and ſo diſpoſed as to repreſent diſtinctly what paſſes within the mind in tracing the more diſtant relations of its ideas. The two firſt propoſitions anſwer the two previous judgments in reaſoning, and are called the *premiſes*, becauſe they are placed before the other. The third is termed the *concluſion*, as being gained in conſequence of what was aſſerted in the premiſes. We are alſo to remember that the terms expreſſing the two ideas whoſe relation we inquire after, as here *man* and *accountableneſs* are in general called the *extremes*; and that the intermediate idea, by means of which the relation is traced, *viz. a creature poſſeſſed of reaſon and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premiſes* of a ſyllogiſm we are always to underſtand the two propoſitions where the middle term is ſeverally compared with *extremes*; for theſe conſtitute the previous judgments whence the truth we are in queſt of is by reaſoning deduced. The *concluſion* is that other propoſition in which the *extremes* themſelves are joined or ſeparated, agreeably to what appears upon the above compariſon. All this is evidently ſeen in the foregoing ſyllogiſm where the two firſt propoſitions which repreſent the premiſes, and the third that makes the concluſion, are exactly agreeable to the definitions here given.

Major and minor term, major and minor propoſition.

VI. Before we take leave of this article, it will be farther neceſſary to obſerve, that as the concluſion is made up of the extreme terms of the ſyllogiſms, ſo that extreme which ſerves as the predicate of the concluſion, goes by the name of the *major term*; the other extreme which makes the ſubject in the ſame propoſition, is called the *minor term*. From this diſtinction of the extremes, ariſes alſo a diſtinction between the premiſes where theſe extremes are ſeverally compared with the middle term. That propoſition which compares the greater extreme, or the predicate of the concluſion with the middle term, is called the *major propoſition*; the other, wherein the ſame middle term is compared with the ſubject of the concluſion or leſſer extreme, is called the *minor propoſition*. All this is obvious from the ſyllogiſm already given, where the concluſion is *man is accountable for his actions*; for here the predicate, *accountable for his actions*, being connected with the middle term in the firſt of the two premiſes, *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, gives what we call the *major propoſition*. In the ſecond of the premiſes, *man is a creature poſſeſſed of reaſon and liberty*, we find the leſſer extreme or ſubject of the concluſion, *viz. man*, connected with the ſame middle term, whence it is known to be the *minor propoſition*. I ſhall only add, that when a ſyllogiſm is propoſed in due form, the major propoſition is always placed firſt, the minor next, and the concluſion laſt, according as we have done in that offered above.

Judgment and propoſition, reaſoning and ſyllogiſm, diſtinguiſhed.

VII. Having thus cleared the way by explaining ſuch terms as we are likely to have occaſion for in the progreſs of this Treatiſe, it may not be amiſs to obſerve, that though we have carefully diſtinguiſhed between the *act of reaſoning* and a *ſyllogiſm*, which is no more than the expreſſion of it, yet common language is not ſo critical on this head; the term *reaſoning* being promiſcuouſly uſed to ſignify either the judgments of the mind as they follow one another in train, or the propoſitions expreſſing theſe judgments. Nor need we wonder that it is ſo, inaſmuch as our ideas and the terms appropriated to them, are ſo connected by habit and uſe, that our thoughts fall, as it were, ſpontaneouſly into language as faſt as they ariſe in the mind; ſo that even in our reaſonings within ourſelves, we are not able wholly to lay aſide words. But notwithſtanding this ſtrict connection between *mental* and *verbal* reaſoning, if I may be allowed that expreſſion, I thought it needful here to diſtinguiſh them, in order to give a juſt idea of the manner of deducing one truth from another. While the mind keeps the ideas of things in view, and combines its judgments according to the real evidence attending them, there is no great danger of miſtake in our reaſonings, becauſe we carry our concluſions no farther than the clearneſs of our perceptions warrants us. But where we make uſe of words, the caſe is often otherwiſe; nothing being more common than to let them paſs without attending to the ideas they repreſent; inſomuch that we frequently combine expreſſions which upon examination appear to have no determinate meaning. Hence it greatly imports us to diſtinguiſh between reaſoning and ſyllogiſm, and to take care that the one be in all caſes the true and juſt repreſentation of the other. However, as I am unwilling to recede too far from the common forms of ſpeech, or to multiply diſtinctions without neceſſity, I ſhall henceforward conſider propoſitions as repreſenting the real judgments of the mind, and ſyllogiſms as the true copies of our reaſonings; which indeed they ought always to be, and undoubtedly always will be, to men who think juſtly, and are deſirous of arriving at truth. Upon this ſuppoſition there will be no danger in uſing the words Judgment and Propoſition promiſcuouſly; or, in conſidering reaſoning as either a combination of various judgments, or of the propoſitions expreſſing them; becauſe, being the exact copies one of another, the reſult will be in all caſes the ſame. Nor is it a ſmall advantage that we can thus conform to common ſpeech without confounding our ideas, or running into ambiguity. By this means we bring ourſelves upon a level with other men, readily apprehend the meaning of their expreſſions, and can with eaſe convey our own notions and ſentiments into their minds.

In a ſingle act of reaſoning, the premiſes muſt be intuitive truths.

VIII. Theſe things premiſed, we may in the general define reaſoning *to be an act or operation of the mind, deducing ſome unknown propoſition from other previous ones that are evident and known.* Theſe previous propoſitions, in a ſimple act of reaſoning, are only two in number; and it is always required that they be of themſelves apparent to the underſtanding, inſomuch that we aſſent to and perceive the truth of them as ſoon as propoſed. In the ſyllogiſm given above, the premiſes are ſuppoſed to be ſelf-evident truths, otherwiſe the concluſion could not be inferred by a ſingle act of reaſoning. If, for inſtance, in the major, *every creature poſſeſſed of reaſon and liberty is accountable for his actions,* the connection between the ſubject and predicate could not be perceived by a bare attention to the ideas themſelves, it is evident that this propoſition would no leſs require a proof than the concluſion deduced from it. In this caſe a new middle term muſt be ſought for, to trace the connection here ſuppoſed; and this of courſe furniſhes another ſyllogiſm, by which, having eſtabliſhed the propoſition in queſtion, we are then, and not before, at liberty to uſe it in any ſucceeding train of reaſoning. And ſhould it ſo happen that in this ſecond eſſay there was ſtill ſome previous propoſition whoſe turn did not appear at firſt ſight, we muſt then have recourſe to a third ſyllogiſm, in order to lay open that truth to the mind; becauſe, ſo long as the premiſes remain uncertain, the concluſion built upon them muſt be ſo too. When by conducting our thoughts in this manner, we at laſt arrive at ſome ſyllogiſm, where the previous propoſitions are intuitive truths, the mind then reſts in full ſecurity, as perceiving that the ſeveral concluſions it has paſſed through, ſtand upon the immoveable foundation of ſelf-evidence, and when traced to their ſource terminate in it.

Reaſoning, in the higheſt exerciſe of it, only a conca-

IX. We ſee therefore, that in order to infer a concluſion by a ſingle act of reaſoning, the premiſes muſt tenation of ſyllogiſms.

be intuitive propoſitions. Where they are not, previous ſyllogiſms are required, in which caſe reaſoning becomes a complicated act, taking in a variety of ſucceſſive ſteps. This frequently happens in tracing the more remote relations of our ideas, where many middle terms being called in, the concluſion cannot be made out, but in conſequence of a ſeries of ſyllogiſms following one another in train. But although in this concatenation of propoſitions, thoſe that form the premiſes of the laſt ſyllogiſm are often conſiderably removed from ſelf-evidence, yet, if we trace the reaſoning backwards, we ſhall find them the concluſions of previous ſyllogiſms, whoſe premiſes approach nearer and nearer to intuition, in proportion as we advance, and are found at laſt to terminate in it. And if after having thus unravelled a demonſtration, we take it the contrary way, and obſerve how the mind, ſetting out with intuitive perceptions, couples them together to form a concluſion; how, by introducing this concluſion into another ſyllogiſm, it ſtill advances one ſtep farther, and ſo proceeds, making every new diſcovery ſubſervient to its future progreſs, we ſhall then perceive clearly, that reaſoning, in the higheſt exerciſe of that faculty, is no more than an orderly combination of thoſe ſimple acts which we have already ſo fully explained. The great art lies in ſo adjuſting our ſyllogiſms one to another, that the propoſitions ſeverally made uſe of as premiſes, may be manifeſt conſequences of what goes before; for, as by this means every concluſion is deduced from known and eſtabliſhed truths, the very laſt in the ſeries, how far ſoever we carry it, will have no leſs certainty attending it than the original intuitive perceptions themſelves, in which the whole chain of ſyllogiſms takes its riſe.

Requires intuitive certainty in every ſtep of the progreſſion.

X. Thus we ſee that reaſoning beginning with firſt principles, riſes gradually from one judgment to another, and connects them in ſuch manner, that every ſtage of the progreſſion brings intuitive certainty along with it. And now at length we may clearly underſtand the definition given above of this diſtinguiſhing faculty of the human mind. Reaſon, we have ſaid, is the ability of deducing unknown truths from principles or propoſitions that are already known. This evidently appears by the foregoing account, where we ſee that no propoſition is admitted into a ſyllogiſm, to ſerve as one of the previous judgments on which the concluſion reſts, unleſs it is itſelf a known and eſtabliſhed truth, whoſe connection with ſelf-evident principles has been already traced.

Self-evident truths, the

XI. There is yet another obſervation which naturally offers itſelf, in conſequence of the above detail, viz. that all the knowledge acquired by reaſoning, how far ſoever we carry our diſcoveries, is ſtill built upon our intuitive perceptions. Towards the end of the laſt part we divided propoſitions into ſelf-evident and demonſtrable, and repreſented thoſe of the ſelf-evident kind as the foundation on which the whole ſuperſtructure of human ſcience reſted. This doctrine is now abundantly confirmed by what has been delivered in the preſent chapter. We have found that every diſcovery of human reaſon is the conſequence of a train of ſyllogiſms, which when traced to their ſource, always terminates in ſelf-evident perceptions. When the mind arrives at theſe primitive truths, it purſues not its enquiries farther, as well knowing that no evidence can exceed that which flows from an immediate view of the agreement or diſagreement between its ideas. And hence it is that, in unravelling any part of knowledge, in order to come at the foundation on which it ſtands, intuitive truths are always the laſt reſort of the underſtanding, beyond which it aims not to advance, but poſſeſſes its notions in perfect ſecurity, as having now reached the very ſpring and fountain of all ſcience and certainty.

ultimate foundation of all ſcience and certainty.

CHAP. II.

Of the ſeveral Kinds of Reaſoning, and firſt of that by which we determine the Genera and Species of Things.

Reaſoning twofold.

I. WE have endeavoured in the foregoing chapter to give as diſtinct a notion as poſſible of reaſoning, and of the manner in which it is conducted. Let us now enquire a little into the diſcoveries made by this faculty, and what thoſe ends are which we have principally in view in the exerciſe of it. All the aims of human reaſon may in the general be reduced to theſe two: 1. To rank things under thoſe univerſal ideas to which they truly belong; and, 2. To aſcribe to them their ſeveral attributes and properties in conſequence of that diſtribution.

The firſt kind regards the genera and ſpecies of things.

II. Firſt, then I ſay, that one great aim of human reaſon is, to determine the genera and ſpecies of things. We have ſeen in the firſt part of this Treatiſe, how the mind proceeds in framing general ideas. We have alſo ſeen in the ſecond part, how by means of theſe general ideas, we come by univerſal propoſitions. Now, as in theſe univerſal propoſitions, we affirm ſome property of a genus or ſpecies, it is plain that we cannot apply this property to particular objects till we have firſt determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which, nevertheleſs, cannot be applied to any particular number until we have firſt diſcovered it to be of the ſpecies expreſſed by that general name. Hence reaſoning begins with referring things to their ſeveral diviſions and claſſes in the ſcale of our ideas; and as theſe diviſions are all diſtinguiſhed by peculiar names, we hereby learn to apply the terms expreſſing general conceptions to ſuch particular objects as come under our immediate obſervation.

The ſteps by which we arrive at, concluſions of this ſort.

III. Now, in order to arrive at theſe concluſions, by which the ſeveral objects of perception are brought under general names, two things are manifeſtly neceſſary. Firſt, That we take a view of the idea itſelf denoted by that general name, and carefully attend to the diſtinguiſhing marks which ſerve to characterize it. Secondly, That we compare this idea with the object under conſideration, obſerving diligently wherein they agree or differ. If the idea is found to correſpond with the particular object, we then without heſitation apply the general name; but if no ſuch correſpondence intervenes, the concluſion muſt neceſſarily take a contrary turn. Let us, for inſtance, take the number *eight*, and conſider by what ſteps we are led to pronounce it an *even* number. Firſt then, we call to mind the idea ſignified by the expreſſion *an even number, viz.* that it is *a number diviſible into* two *equal parts*. We then compare this idea with the number *eight*, and finding them manifeſtly to agree, ſee at once the neceſſity of admitting the concluſion. Theſe ſeveral judgments therefore, transferred into language, and reduced to the form of a ſyllogiſm, appear thus:

Every number that may be divided into two equal parts, is an EVEN *number.*

The number EIGHT *may be divided into two equal parts;*

Therefore the number EIGHT *is an* EVEN *number.*

Thoſe ſteps always followed, though in familiar caſes we do not always attend to them.

IV. I have made choice of this example, not ſo much for the ſake of the concluſion, which is obvious enough, and might have been obtained without all that parade of words, but chiefly becauſe it is of eaſy comprehenſion, and ſerves at the ſame time diſtinctly to exhibit the form of reaſoning by which the underſtanding conducts itſelf in all inſtances of this kind. And here it may be obſerved, that where the general idea to which particular objects are referred, is very familiar to the mind, and frequently in view, this reference, and the application of the general name, ſeem to be made without any apparatus of reaſoning. When we ſee a horſe in the fields, or a dog in the ſtreet, we readily apply the name of the ſpecies; habit, and a familiar acquaintance with the general idea, ſuggeſting it inſtantaneouſly to the mind. We are not however to imagine on this account, that the underſtanding departs from the uſual rules of juſt thinking. A frequent repetition of acts begets a habit; and habits are attended with a certain promptneſs of execution, that prevents our obſerving the ſeveral ſteps and gradations by which any courſe of action is accompliſhed. But in other inſtances, where we judge not by precontracted habits, as when the general idea is very complex, or leſs familiar to the mind, we always proceed according to the form of reaſoning eſtabliſhed above. A goldſmith, for inſtance, who is in doubt as to any piece of metal, whether it be of the ſpecies called *gold*, firſt examines its properties, and then comparing them with the general idea ſignified by that name, if he finds a perfect correſpondence, no longer heſitates under what claſs of metals to rank it. Now what is this but following ſtep by ſtep thoſe rules of reaſoning which we have before laid down as the ſtandards by which to regulate our thoughts in all concluſions of this kind?

The great importance of this branch of reaſoning,

V. Nor let it be imagined that our reſearches here, becauſe in appearance bounded to the impoſing of general names upon particular objects, are therefore trivial and of little conſequence. Some of the moſt conſiderable debates among mankind, and ſuch too as nearly regard their lives, intereſt, and happineſs, turn wholly upon this article. Is it not the chief employment of our ſeveral courts of judicature, to determine in particular inſtances, what is law, juſtice, and equity? Of what importance is it in many caſes, to decide aright, whether an action ſhall be termed murder or manſlaughter? We ſee that no leſs than the lives and fortunes of men depend often upon theſe deciſions. The reaſon is plain. Actions when once referred to a general idea, draw after them all that may be affirmed of that idea; inſomuch that the determining the ſpecies of actions, is all one with determining what proportion of praiſe or diſpraiſe, commendation or blame, &c. ought to follow them; for as it is allowed that murder deſerves death, by bringing any particular action under the head of murder, we of courſe decide the puniſhment due to it.

and the exact obſervance of it practiſed by mathematicians.

VI. But the great importance of this branch of reaſoning, and the neceſſity of care and circumſpection, in referring particular objects to general ideas, is ſtill farther evident from the practice of the mathematicians. Every one who has read *Euclid*, knows that he frequently requires us to draw lines through certain points, and according to ſuch and ſuch directions. The figures thence reſulting are often ſquares, parallelograms, or rectangles. Yet *Euclid* never ſuppoſes this from their bare appearance, but always demonſtrates it upon the ſtricteſt principles of geometry. Nor is the method he takes in any thing different from that deſcribed above. Thus, for inſtance, having defined a ſquare to be a figure bounded by four equal ſides, joined together at right angles; when ſuch a figure ariſes in any conſtruction previous to the demonſtration of a propoſition, he yet never calls it by that name until he has ſhewn that the ſides are equal, and all its angles right ones. Now this is apparently the ſame form of reaſoning we have before exhibited, in proving *eight* to be an even number; as will be evident to any one who reduces it into a regular ſyllogiſm. I ſhall only add, that when *Euclid* has thus determined the ſpecies of any figure, he is then, and not before, at liberty to aſcribe to it all the properties already demonſtrated of that figure, and thereby render it ſubſervient to the future courſe of his reaſoning.

Fixed and invariable ideas, with a ſteady application of names, renders this part of knowledge both eaſy and certain.

VII. Having thus ſufficiently explained the rules by which we are to conduct ourſelves, in ranking particular objects under general ideas, and ſhewn their conformity to the practice and manner of the mathematicians, it remains only to obſerve, that the true way of rendering this part of knowledge both eaſy and certain is, by habituating ourſelves to clear and determinate ideas, and keeping them ſteadily annexed to their reſpective names. For as all our aim is to apply general words aright, if theſe words ſtand for invariable ideas, that are perfectly known to the mind, and can be readily diſtinguiſhed upon occaſion, there will be little danger of miſtake or error in our reaſonings. Let us ſuppoſe that by examining any object, and carrying our attention ſucceſſively from one part to another, we have acquainted ourſelves with the ſeveral particulars obſervable in it. If among theſe we find ſuch as conſtitute ſome general idea, framed and ſettled beforehand by the underſtanding, and diſtinguiſhed by a particular name, the reſemblance thus known and perceived neceſſarily determines the ſpecies of the object, and thereby gives it a right to the name by which that ſpecies is called. Thus four equal ſides, joined together at right angles, make up the notion of a *ſquare*. As this is a fixed and invariable idea, without which the general name cannot be applied, we never call any particular figure a *ſquare*, until it appears to have theſe ſeveral conditions; and, contrarily, wherever a figure is found with theſe conditions, it neceſſarily takes the name of *ſquare*. The ſame will be found to hold in all our other reaſonings of this kind, where nothing can create any difficulty but the want of ſettled ideas. If, for inſtance, we have not determined within ourſelves, the preciſe notion denoted by the word *manſlaughter*, it will be impoſſible for us to decide whether any particular action ought to bear that name; becauſe, however nicely we examine the action itſelf, yet being ſtrangers to the general idea with which it is to be compared, we are utterly unable to judge of their agreement or diſagreement. But if we take care to remove this obſtacle, and diſtinctly trace the two ideas under conſideration, all difficulties vaniſh, and the reſolution becomes both eaſy and certain.

By ſuch a conduct, certainty and demonſtration might be introduced into

VIII. Thus we ſee of what importance it is, towards the improvement and certainty of human knowledge, that we accuſtom our-other parts of knowledge as well as mathematics.

ſelves to clear and determinate ideas, and a ſteady application of words. Nor is this ſo eaſy a taſk as ſome may perhaps be apt to imagine; it requiring both a comprehenſive underſtanding, and great command of attention, to ſettle the preciſe bounds of our ideas when they grow to be very complex, and include a multitude of particulars. Nay, and after theſe limits are duly fixed, there is a certain quickneſs of thought and extent of mind required towards keeping the ſeveral parts in view, that in comparing our ideas one with another, none of them be overlooked. Yet ought not theſe difficulties to diſcourage us; though great, they are not unſurmountable, and the advantages ariſing from ſucceſs will amply recompenſe our toil. The certainty and eaſy application of mathematical knowledge is wholly owing to the exact obſervance of this rule. And I am apt to imagine, that if we were to employ the ſame care about all our other ideas, as mathematicians have done about thoſe of number and magnitude, by forming them into exact combinations, and diſtinguiſhing theſe combinations by particular names, in order to keep them ſteady and invariable, we ſhould ſoon have it in our power to introduce certainty and demonſtration into other parts of human knowledge.

CHAP. III.

Of Reaſoning, as it regards the Powers and Properties of Things, and the Relations of our general Ideas.

The diſtinction of reaſoning as it regards the ſciences, and as it concerns common life.

I. WE come now to the ſecond great end which men have in view in their reaſonings, namely, The diſcovering and aſcribing to things their ſeveral attributes and properties. And here it will be neceſſary to diſtinguiſh between reaſoning, as it regards the ſciences, and as it concerns common life. In the ſciences, our reaſon is employed chiefly about univerſal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the diviſion of things into various claſſes, called otherwiſe genera and ſpecies. For theſe univerſal ideas, being ſet up as the repreſentatives of many particular things, whatever is affirmed of them, may alſo be affirmed of all the individuals to which they belong. *Murder*, for inſtance, is a general idea, repreſenting a certain ſpecies of human actions. Reaſon tells us, that the puniſhment due to it is *death*. Hence every particular action coming under the notion of *murder*, has the puniſhment of *death* allotted to it. Here then we apply the general truth to ſome obvious inſtance; and this is what properly conſtitutes the reaſoning of common life; for men, in their ordinary tranſactions and intercourſe one with another, have for the moſt part to do only with particular objects. Our friends and relations, their characters and behaviours, the conſtitution of the ſeveral bodies that ſurround us, and the uſes to which they may be applied, are what chiefly engage our attention. In all theſe we reaſon about particular things; and the whole reſult of our reaſoning is, the applying the general truths of the ſciences to the ordinary tranſactions of human life. When we ſee a viper, we avoid it. Wherever we have occaſion for the forcible action of water to move a body that makes conſiderable reſiſtance, we take care to convey it in ſuch a manner that it ſhall fall upon the object with impetuoſity. Now all this happens in conſequence of our familiar and ready application of theſe two general truths: *The bite of a viper is mortal: water falling upon a body with impetuoſity, acts very forcibly towards ſetting it in motion.* In like manner, if we ſet ourſelves to conſider any particular character, in order to determine the ſhare of praiſe or diſpraiſe that belongs to it, our great concern is, to aſcertain exactly the proportion of virtue and vice. The reaſon is obvious. A juſt determination in all caſes of this kind depends entirely upon an application of theſe general maxims of morality : *Virtuous actions deſerve praiſe : Vicious actions deſerve blame.*

The ſteps by which we proceed in the reaſoning of common life.

II. Hence it appears, that reaſoning, as it regards common life, is no more than the aſcribing the general properties of things to thoſe ſeveral objects with which we are immediately concerned, according as they are found to be of that particular diviſion or claſs to which the properties belong. The ſteps then by which we proceed are manifeſtly theſe: Firſt, we refer the object under conſideration to ſome general idea or claſs of things: we then recollect the ſeveral attributes of that general idea : and laſtly, aſcribe all thoſe attributes to the preſent object. Thus, in conſidering the character of *Sempronius*, if we find it to be of the kind called *virtuous*; when we at the ſame time reflect that a *virtuous* character is deſerving of eſteem, it naturally and obviouſly follows, that *Sempronius* is ſo too. Theſe thoughts put into a *ſyllogiſm*, in order to exhibit the form of reaſoning here required, run thus :

Every virtuous man is worthy of eſteem.
Sempronius is a virtuous man ;
Therefore Sempronius is worthy of eſteem.

I.

The connection and dependence of the two grand branches of reaſoning one upon another.

III. By this *ſyllogiſm*, it appears that, before we affirm any thing of a particular object, that object muſt be referred to ſome general idea. *Sempronius* is pronounced worthy of eſteem, only in conſequence of his being a virtuous man, or coming under that general notion. Hence we ſee the neceſſary connection of the various parts of reaſoning, and the dependence they have one upon another. The determining the genera and ſpecies of things is, as we have ſaid, one exerciſe of human reaſon; and here we find that this exerciſe is the firſt in order, and previous to the other, which conſiſts in aſcribing to them their powers, properties, and relations. But when we have taken this previous ſtep, and brought particular objects under general names; as the properties we aſcribe to them are no other than thoſe of the general idea, it is plain that, in order to a ſucceſsful progreſs in this part of knowledge, we muſt thoroughly acquaint ourſelves with the ſeveral relations and attributes of theſe our general ideas. When this is done, the other part will be eaſy, and require ſcarce any labour of thought, as being no more than an application of the general form of reaſoning repreſented in the foregoing *ſyllogiſm*. Now, as we have already ſufficiently ſhewn how we are to proceed in determining the genera and ſpecies of things, which, as we have ſaid, is the previous ſtep to this ſecond branch of human knowledge, all that is farther wanting to a due explanation of it, is to offer ſome conſiderations, as to the manner of inveſtigating the general relations of our ideas. This is the higheſt exerciſe of the powers of the underſtanding, and that by means whereof we arrive at the diſcovery of univerſal truths; inſomuch that our deductions in this way conſtitute that particular ſpecies of reaſoning which we have before ſaid regards principally the ſciences.

Two things required to make a good reaſoner.

IV. But that we may conduct our thoughts with ſome order and method, we ſhall begin with obſerving, that the relations of our general ideas are of two kinds: either ſuch as immediately diſcover themſelves, upon comparing the ideas one with another; or ſuch, as being more remote and diſtant, require art and contrivance to bring them into view. The relations of the firſt kind furniſh us with intuitive and ſelf-evident truths; thoſe of the ſecond are traced by reaſoning, and a due application of intermediate ideas. It is of this laſt kind that we are to ſpeak here, having diſpatched what was neceſſary with regard to the other in the ſecond part. As therefore in tracing the more diſtant relations of things, we muſt always have recourſe to intervening ideas, and are more or leſs ſucceſsful in our reſearches, according to our acquaintance with theſe ideas and ability of applying them, it is evident that, to make a good reaſoner, two things are principally required: *firſt*, An extenſive knowledge of thoſe intermediate ideas by means of which things may be compared one with another: *ſecondly*, The ſkill and talent of applying them happily, in all particular inſtances that come under conſideration.

First, an extenſive knowledge of intermediate ideas.

V. Firſt, I ſay that, in order to our ſucceſsful progreſs in reaſoning, we muſt have an extenſive knowledge of thoſe intermediate ideas, by means of which things may be compared one with another; for as it is not every idea that will anſwer the purpoſe of our enquiries, but ſuch only as are peculiarly related to the objects about which we reaſon, ſo as, by a compariſon with them, to furniſh evident and known truths, nothing is more apparent than that the greater variety of conceptions we can call into view, the more likely we are to find ſome among them that will help us to the truths here required. And indeed it is found to hold in experience, that in proportion as we enlarge our view of things, and grow acquainted with a multitude of different objects, the reaſoning faculty gathers ſtrength; for by extending our ſphere of knowledge, the mind acquires a certain force and penetration, as being accuſtomed to examine the ſeveral appearances of its ideas, and obſerve what light they caſt one upon another.

To excel in any one branch of learning, we muſt be in general acquainted with the whole circle of arts and ſciences.

VI. And this I take to be the reaſon that, in order to excel remarkably in any one branch of learning, it is neceſſary to have at leaſt a general acquaintance with the whole circle of arts and ſciences. The truth of it is, all the various diviſions of human knowledge are very nearly related among themſelves, and in innumerable inſtances ſerve to illuſtrate and ſet off each other. And altho' it is not to be denied that, by an obſtinate application to one branch of ſtudy, a man may make conſiderable progreſs, and acquire ſome degree of eminence in it, yet his views will be always narrow and contracted, and he will want that maſterly diſcernment which not only enables us to purſue our diſcoveries with eaſe, but alſo in laying them open to others, to ſpread a certain brightneſs around them. I would not however here be underſtood to mean, that a general knowledge alone is ſufficient for all the purpoſes of reaſoning; I only recommend it as proper to give the mind a certain ſagacity and quickneſs, and qualify it for judging aright in the ordinary occurrences of life. But when our reaſoning regards a particular ſcience, it is farther neceſſary that we more nearly acquaint ourſelves with whatever relates to that ſcience. A general knowledge is a good preparation, and enables us to proceed with eaſe and expedition in whatever branch of learning we apply to; but then in the minute and intricate queſtions of any ſcience, we are by no means qualified to reaſon with advantage, until we have perfectly maſtered the ſcience to which they belong; it being hence chiefly that we are furniſhed with thoſe intermediate ideas which lead to a juſt and ſucceſsful ſolution.

Why mathematicians ſometimes anſwer not the expectation their great learning raiſes.

VII. And here, as it comes ſo naturally in my way, I cannot avoid taking notice of an obſervation that is frequently to be met with, and ſeems to carry in it at firſt ſight ſomething very ſtrange and unaccountable. It is in ſhort this, that *mathematicians*, even ſuch as are allowed to excel in their own profeſſion, and to have diſcovered themſelves perfect maſters in the art of reaſoning, have not yet been always happy in treating upon other ſubjects; but rather fallen ſhort, not only of what might naturally have been expected from them, but of many writers much leſs exerciſed in the rules of argumentation. This will not appear ſo very extraordinary, if we reflect on what has been hinted above. *Mathematics* is an engaging ſtudy; and men who apply themſelves that way, ſo wholly plunge into it, that they are for the moſt part but little acquainted with other branches of knowledge. When therefore they quit their favourite ſubject, and enter upon others that are in a manner new and ſtrange to them, no wonder if they find their invention at a ſtand. Becauſe however perfect they may be in the art of reaſoning, yet wanting here thoſe intermediate ideas which are neceſſary to furniſh out a due train of propoſitions, all their ſkill and ability fails them; for a bare knowledge of the rules is not ſufficient: we muſt farther have materials whereunto to apply them. And when theſe are once obtained, then it is that an able reaſoner diſcovers his ſuperiority, by the juſt choice he makes, and a certain maſterly diſpoſition, that in every ſtep of the procedure carries evidence and conviction along with it. And hence it is that ſuch *mathematicians* as have of late years applied themſelves to other ſciences, and not contented with a ſuperficial knowledge, endeavoured to reach their inmoſt receſſes; ſuch mathematicians, I ſay, have by mere ſtrength of mind, and a happy application of *geometrical* reaſoning, carried their diſcoveries far beyond what was heretofore judged the utmoſt limits of human knowledge. This is a truth abundantly known to all who are acquainted with the late wonderful improvements in natural philoſophy.

Secondly, The ſkill of applying intermediate ideas happily in particular inſtances.

VIII. I come now to the ſecond thing required, in order to a ſucceſsful progreſs in reaſoning; namely, the ſkill and talent of applying intermediate ideas happily in all particular inſtances that come under conſideration. And here I ſhall not take up much time in laying down rules and precepts, becauſe I am apt to think they would do but little ſervice. Uſe and exerciſe are the beſt inſtructors in the preſent caſe: and whatever logicians may boaſt, of being able to form perfect reaſoners by book and rule, yet we find by experience that the ſtudy of their precepts does not always add any great degree of ſtrength to the underſtanding. In ſhort, 'tis the habit alone of reaſoning that makes a reaſoner; and therefore the true way to acquire this talent is, by being much converſant in thoſe ſciences where the art of reaſoning is allowed to reign in the greateſt perfection. Hence it was that the antients, who ſo well underſtood the manner of forming the mind, always began with *mathematics* as the foundation of their philoſophical ſtudies. Here the underſtanding is by degrees habituated to truth, contracts inſenſibly a certain fondneſs for it, and learns never to yield its aſſent to any propoſition but where the evidence is ſufficient to produce full conviction. For this reaſon *Plato* has called mathematical demonſtrations the *cathartics* or purgatives of the ſoul, as being the proper means to cleanſe it from error, and reſtore that natural exerciſe of its faculties in which juſt thinking conſiſts. And indeed I believe it will be readily allowed, that no ſcience furniſhes ſo many inſtances of a happy choice of intermediate ideas, and a dexterous application of them, for the diſcovery of truth and enlargement of knowledge.

The ſtudy of mathematical demonſtrations of great avail in this reſpect;

IX. If therefore we would form our minds to a habit of reaſoning cloſely and in train, we cannot take any more certain method than the exerciſing ourſelves in mathematical demonſtrations, ſo as to contract a kind of familiarity with them, "Not that we look upon "it as neceſſary (*to uſe the words of the great Mr. Locke*) "that all men ſhould be deep "mathematicians, but that, having got the "way of reaſoning which that ſtudy neceſſa-"rily brings the mind to, they may be able to "transfer it to other parts of knowledge, as "they ſhall have occaſion; for in all ſorts of "reaſoning, every ſingle argument ſhould "be managed as a mathematical demonſtra-"tion, the connection and dependence of

" ideas ſhould be followed till the mind is " brought to the ſource on which it bottoms, " and can trace the coherence through the " whole train of proofs. It is in the general " obſervable, that the faculties of our ſouls are " improved and made uſeful to us juſt after the " ſame manner as our bodies are. Would you " have a man write or paint, dance or fence " well, or perform any other manual operation " dexterouſly and with eaſe? Let him have " ever ſo much vigour and activity, ſuppleneſs " and addreſs naturally, yet nobody expects this " from him unleſs he has been uſed to it, and " has employed time and pains in faſhioning " and forming his hand, or outward parts, to " theſe motions. Juſt ſo it is in the mind; " would you have a man reaſon well, you muſt " uſe him to it betimes, exerciſe his mind in " obſerving the connection of ideas, and following them in train. Nothing does this " better than mathematics; which therefore " I think ſhould be taught all thoſe who have " the time and opportunity, not ſo much " to make them mathematicians, as to make " them reaſonable creatures; for though we " all call ourſelves ſo, becauſe we are born to " it if we pleaſe, yet we may truly ſay, nature gives us but the ſeeds of it. We are born " to be, if we pleaſe, rational creatures; but " 'tis uſe and exerciſe only that makes us ſo;

"and we are indeed ſo, no farther than induſtry "and application has carried us." *Conduct of the Underſtanding.*

as alſo of ſuch authors on other ſubjects, as are diſtinguiſhed for ſtrength and juſtneſs of reaſoning.

X. But although the ſtudy of mathematics be of all others the moſt uſeful to form the mind and give it an early reliſh of truth, yet ought not other parts of philoſophy to be neglected; for there alſo we meet with many opportunities of exerciſing the powers of the underſtanding; and the variety of ſubjects naturally leads us to obſerve all thoſe different turns of thinking that are peculiarly adapted to the ſeveral ideas we examine, and the truths we ſearch after. A mind thus trained, acquires a certain maſtery over its own thoughts, inſomuch that it can range and model them at pleaſure, and call ſuch into view as beſt ſuits its preſent deſigns. Now in this the whole art of reaſoning conſiſts, from among a great variety of different ideas to ſingle out thoſe that are moſt proper for the buſineſs in hand, and to lay them together in ſuch order, that from plain and eaſy beginnings, by gentle degrees, and a continual train of evident truths, we may be inſenſibly led on to ſuch diſcoveries as at our firſt ſetting out appeared beyond the reach of the human underſtanding. For this purpoſe, beſides the ſtudy of mathematics before recommended, we ought to apply ourſelves diligently to the reading of ſuch authors as have diſtinguiſhed themſelves for ſtrength of reaſoning and a juſt and accurate manner of thinking. For it is obſervable, that a mind exerciſed and ſeaſoned to truth ſeldom reſts ſatisfied in a bare contemplation of the arguments offered by others, but will be frequently aſſaying its own ſtrength, and purſuing its diſcoveries upon the plan it is moſt accuſtomed to. Thus we inſenſibly contract a habit of tracing truth from one ſtage to another, and of inveſtigating thoſe general relations and properties which we afterwards aſcribe to particular things, according as we find them comprehended under the abſtract ideas to which the properties belong. And thus having particularly ſhewn how we are to diſtribute the ſeveral objects of nature under general ideas, what properties we are to aſcribe to them in conſequence of that diſtribution, and how to trace and inveſtigate the properties themſelves, I think I have ſufficiently explained all that is neceſſary towards a due conception of reaſoning, and ſhall therefore here conclude this chapter.

CHAP. IV.

Of the Forms of Syllogiſms.

The figures of ſyllogiſms.

I. HITHERTO we have contented ourſelves with a general notion of ſyllogiſms, and of the parts of which they conſiſt: it is now time to enter a little more particularly into the ſubject, to examine their various forms, and to lay open the rules of argumentation proper to each. In the ſyllogiſms mentioned in the foregoing chapters, we may obſerve that the *middle term* is the ſubject of the *major* propoſition, and the predicate of the *minor*. This diſpoſition, tho' the moſt natural and obvious, is not however neceſſary; it frequently happening that the *middle term* is the ſubject in both the premiſes, or the predicate in both; and ſometimes, directly contrary to its diſpoſition in the foregoing chapters, the predicate in the *major*, and the ſubject in the *minor*. Hence the diſtinction of ſyllogiſms into various kinds, called *figures* by logicians; for *figure*, according to their uſe of the word, is nothing elſe but the order and diſpoſition of the *middle term* in any ſyllogiſm: and as this diſpoſition is we ſee fourfold ſo the figures of ſyllogiſms thence ariſing are four in number. When the *middle term* is the ſubject of the *major* propoſition, and the predicate of the *minor*, we have what is called the *firſt figure*. If, on the other hand, it is the predicate of both the premiſes, the ſyllogiſm is ſaid to be in the *ſecond figure*. Again, in the *third figure*, the *middle term* is the ſubject of the two premiſes. And laſtly, by making it the predicate of the *major* and ſubject of the *minor*, we obtain ſyllogiſms in the *fourth figure*.

The moods of ſyllogiſms.

II. But beſides this fourfold diſtinction of ſyllogiſms, there is alſo a farther ſubdiviſion of them in every figure, ariſing from the *quantity* and *quality*, as they are called, of the propoſitions. By *quantity*, we mean the conſideration of propoſitions as univerſal or particular; by *quality*, as affirmative or negative. Now, as in all the ſeveral diſpoſitions of the *middle term*, the propoſitions of which a ſyllogiſm conſiſts may be either univerſal or particular, affirmative or negative; the due determination of theſe, and ſo putting them together as the laws of argumentation require, conſtitute what logicians call the *moods* of ſyllogiſms. Of theſe *moods* there are a determinate number to every figure, including all the poſſible ways in which propoſitions differing in *quantity* or *quality* can be combined according to any diſpoſition of the *middle term*, in order to arrive at a juſt concluſion. The ſhortneſs of the preſent work will not allow of entering into a more particular deſcription of theſe ſeveral diſtinctions and diviſions. I ſhall therefore content myſelf with referring the reader to the *Port-Royal Art of Thinking*, where he will find the *moods* and *figures* of ſyllogiſms diſtinctly explained, and the rules proper to each very neatly demonſtrated.

Foundation of the other diviſions of ſyllogiſms.

III. The diviſion of ſyllogiſms according to mood and figure, reſpects thoſe eſpecially which are known by the name of plain ſimple ſyllogiſms; that is, which are bounded to three propoſitions, all ſimple, and where the extremes and middle term is connected, according to the rules laid down above. But as the mind is not tied down to any one preciſe form of reaſoning, but ſometimes makes uſe of more, ſometimes of fewer premiſes, and often takes in compound and conditional propoſitions, it may not be amiſs to take notice of the different forms derived from this ſource, and explain the rules by which the mind conducts itſelf in the uſe of them.

Conditional ſyllogiſms.

IV. When in any ſyllogiſm the *major* is a conditional propoſition, the ſyllogiſm itſelf is termed *conditional*. Thus:

If there is a God, he ought to be worſhipped.
But there is a God;
Therefore he ought to be worſhipped.

In this example, the *major* or firſt propoſition is, we ſee, conditional, and therefore the ſyllogiſm itſelf is alſo of the kind called by that name. And here we are to obſerve, that all conditional propoſitions are made up of two diſtinct parts; one expreſſing the condition upon which the predicate agrees or diſagrees with the ſubject, as in this now before us, *if there is a God*; the other joining or disjoining the ſaid predicate and ſubject, as here, *he ought to be worſhipped.* The firſt of theſe parts, or that which implies the condition, is called the *antecedent*; the ſecond, where we join or disjoin the predicate and ſubject, has the name of the *conſequent.*

Ground of illation in conditional ſyllogiſms.

V. Theſe things explained, we are farther to obſerve, that in all propoſitions of this kind, ſuppoſing them to be exact in point of form, the relation between the antecedent and conſequent muſt ever be true and real; that is, the antecedent muſt always contain ſome certain and genuine condition, which neceſſarily implies the conſequent; for otherwiſe, the propoſition itſelf will be falſe, and therefore ought not to be admitted into our reaſonings. Hence it follows, that when any conditional propoſition is aſſumed, if we admit the antecedent of that propoſition, we muſt at the ſame time neceſſarily admit the conſequent; but if we reject the conſequent, we are in like manner bound to reject alſo the antecedent; for as the antecedent always expreſſes ſome condition which neceſſarily implies the truth of the conſequent; by admitting the antecedent we allow of that condition, and therefore ought alſo to admit the conſequent. In like manner, if it appears that the conſequent ought to be rejected, the antecedent evidently muſt be ſo too; becauſe as we juſt now demonſtrated, the admitting of the antecedent would neceſſarily imply the admiſſion alſo of the conſequent.

The two moods of conditional ſyllogiſms.

VI. From what has been ſaid, it appears that there are two ways of arguing in *hypothetical* ſyllogiſms, which lead to a certain and unavoidable concluſion; for as the *major* is always a conditional propoſition, conſiſting of an antecedent and a conſequent; if the *minor* admits the antecedent, it is plain that the concluſion muſt admit the conſequent. This is called arguing from the admiſſion of the antecedent to the admiſſion of the conſequent, and conſtitutes that mood or ſpecies of *hypothetical* ſyllogiſms, which is diſtinguiſhed in the ſchools by the name of the *modus ponens*, inaſmuch as by it the whole conditional propoſition, both antecedent and conſequent, is eſtabliſhed. Thus;

If God is infinitely wiſe, and acts with perfect
freedom, he does nothing but what is beſt.
But God is infinitely wiſe, and acts with perfect freedom;
Therefore he does nothing but what is beſt.

Here we ſee the antecedent or firſt part of the conditional propoſition is eſtabliſhed in the *minor*, and the conſequent or ſecond part in the concluſion; whence the ſyllogiſm itſelf is an example of the *modus ponens*. But if now we, on the contrary, ſuppoſe that the *minor* rejects the conſequent, then it is apparent that the concluſion muſt alſo reject the antecedent. In this caſe we are ſaid to argue from the removal of the conſequent to the removal of the antecedent, and the particular mood or ſpecies of ſyllogiſms thence ariſing is called by logicians the *modus tollens*; becauſe in it both antecedent and conſequent are rejected or taken away, as appears by the following example:

If God were not a Being of infinite goodneſs, neither would he conſult the happineſs of his creatures.
But God does conſult the happineſs of his creatures;
Therefore he is a Being of infinite goodneſs.

They include all the legitimate ways of arguing.

VII. Theſe two ſpecies take in the whole claſs of *conditional* ſyllogiſms, and include all the poſſible ways of arguing that lead to a legitimate concluſion, becauſe we cannot here proceed by a contrary proceſs of reaſoning; that is, from the removal of the antecedent to the removal of the conſequent, or from the eſtabliſhing of the conſequent to the eſtabliſhing of the antecedent; for although the antecedent always expreſſes ſome real condition, which once admitted neceſſarily implies the conſequent, yet it does not follow that there is therefore no other condition; and if ſo, then after removing the antecedent, the conſequent may ſtill hold, becauſe of ſome other determination that infers it. When we ſay, *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat*; the propoſition is certainly true, and admitting the antecedent, we muſt alſo admit the conſequent. But as there are other ways by which a ſtone may gather heat, it will not follow, from the ceaſing of the beforementioned condition, that therefore the conſequent cannot take place. In other words, we cannot argue, *But the ſtone has not been expoſed to the rays of the ſun*; *therefore neither has it any degree of heat*; inaſmuch as there are a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the conſequent, no more can we from the admiſſion of the conſequent to the admiſſion of the antecedent; becauſe as the conſequent may flow from a great variety of different ſuppoſitions, the allowing of it does not determine the preciſe ſuppoſition, but only that ſome one of them muſt take place. Thus, in the foregoing propoſition, *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat.* Admitting the conſequent, *viz. that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been ſome time expoſed to the rays of the ſun*; becauſe there are many other cauſes whence that heat may have proceeded. Theſe two ways of arguing therefore hold not in conditional ſyllogiſms. Indeed, where the antecedent expreſſes the only condition on which the conſequent takes place, there they may be applied with ſafety; becauſe wherever that condition is not, we are ſure that neither can the conſequent be, and ſo may argue from the removal of the one to the removal of the other; as, on the contrary, wherever the conſequent holds, it is certain that the condition muſt alſo take place; which ſhews that, by eſtabliſhing the conſequent, we at the ſame time eſtabliſh the antecedent. But as it is a very particular caſe, and that happens but ſeldom, it cannot be extended into a general rule, and therefore affords not any ſteady and univerſal ground of reaſoning upon the two foregoing ſuppoſitions.

The manner of arguing in disjunctive ſyllogiſms.

VIII. As from the *major*'s being a conditional propoſition we obtain the ſpecies of conditional ſyllogiſms, ſo where it is a disjunctive propoſition, the ſyllogiſm to which it belongs is called *disjunctive*, as in the following example:

The world is either ſelf-exiſtent, or the work of ſome finite, or of ſome infinite being.
But it is not ſelf-exiſtent, nor the work of a finite being;
Therefore it is the work of an infinite being.

Now a disjunctive propoſition is that where of ſeveral predicates we affirm one neceſſarily to belong to the ſubject, to the excluſion of all the reſt, but leave that particular one undetermined. Hence it follows, that as ſoon as we determine the particular predicate, all the reſt are of courſe to be rejected; or if we reject all the predicates but one, that one neceſſarily takes place. When therefore in a *disjunctive* ſyllogiſm, the ſeveral predicates are enumerated in the *major*,—if the *minor* eſtabliſhes any one of theſe predicates, the concluſion ought to remove all the reſt; or if in the *minor* all the predicates but one are removed, the concluſion muſt neceſſarily eſtabliſh that one. Thus in the *disjunctive* ſyllogiſm given above, the *major* affirms one of three predicates to belong to the earth, *viz.* *ſelf-exiſtence*, or that it is *the work of a finite*, or that it is *the work of an infinite being*. Two of theſe predicates are removed in the *minor*, *viz.* *ſelf-exiſtence*, and *the work of a finite being*. Hence the concluſion neceſſarily aſcribes to it the third predicate, and affirms that it is *the work of an infinite being*. If now we give the ſyllogiſm another turn, inſomuch that the minor may eſtabliſh one of the predicates, by affirming the earth to be *the production of an infinite being*, then the concluſion muſt remove the other two, aſſerting it to be neither *ſelf-exiſtent* nor *the work of a finite being*. Theſe are the forms of reaſoning in this ſpecies of ſyllogiſms, the juſtneſs of which appears at firſt ſight; and that there can be no other, is evident from the very nature of a disjunctive propoſition.

Imperfect or mutilated ſyllogiſms.

IX. In the ſeveral kinds of ſyllogiſms hitherto mentioned, we may obſerve that the parts are complete; that is, the three propoſitions of which they conſiſt are repreſented in form. But it often happens that ſome one of the premiſes is not only an evident truth, but alſo familiar, and in the minds of all men; in which caſe it is uſually omitted, whereby we have an imperfect ſyllogiſm, that ſeems to be made up of only two propoſitions. Should we, for inſtance, argue in this manner:

Every man is mortal;
Therefore every king is mortal;

the ſyllogiſm appears to be imperfect, as conſiſting but of two propoſitions. Yet it is really complete, only the *minor* (*every king is a man*) is omitted, and left to the reader to ſupply, as being a propoſition ſo familiar and evident, that it cannot eſcape him.

Enthymemes.

X. Theſe ſeemingly imperfect ſyllogiſms are called *Enthymemes*, and occur very frequently in reaſoning, eſpecially where it makes a part of common converſation. Nay, there is a particular elegance in them, becauſe not diſplaying the argument in all its parts, they leave ſomewhat to the exerciſe and invention of the mind. By this means we are put upon exerting ourſelves, and ſeem to ſhare in the diſcovery of what is propoſed to us. Now this is the great ſecret of fine writing, ſo to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him inſenſibly into our very views and courſe of reaſoning. This gives a pleaſure not unlike to that which the author feels himſelf in compoſing. It beſides ſhortens diſcourſe, and adds a certain force and livelineſs to our arguments, when the words in which they are conveyed favour the natural quickneſs of the mind in its operations, and a ſingle expreſſion is left to exhibit a whole train of thoughts.

Ground of reaſoning in immediate conſequences.

XI. But there is another ſpecies of reaſoning with two propoſitions, which ſeems to be complete in itſelf, and where we admit the concluſion without ſuppoſing any tacit or ſuppreſſed judgment in the mind, from which it follows ſyllogiſtically. This happens between propoſitions where the connection is ſuch, that the admiſſion of the one, neceſſarily, and at the firſt ſight, implies the admiſſion alſo of the other. For if it ſo falls out that the propoſition on which the other depends is ſelf-evident, we content ourſelves with barely affirming it, and infer that other by a direct concluſion. Thus by admitting an univerſal propoſition, we are forced alſo to admit of all the particular propoſitions comprehended under it, this being the very condition that conſtitutes a propoſition univerſal. If then that univerſal propoſition chances to be ſelf-evident, the particular ones follow of courſe, without any farther train of reaſoning. Whoever allows, for inſtance, *that things equal to one and the ſame thing are equal to one another*, muſt at the ſame time allow *that two triangles, each equal to a ſquare whoſe ſide is three inches, are alſo equal between themſelves.* This argument therefore,

Things equal to one and the ſame thing, are
equal to one another;
Therefore thoſe two triangles, each equal to
the ſquare of a line of three inches, are
equal between themſelves,

is complete in its kind, and contains all that is neceſſary towards a juſt and legitimate concluſion; for the firſt or univerſal propoſition is ſelf-evident, and therefore requires no farther proof: and as the truth of the particular is inſeparably connected with that of the univerſal, it follows from it by an obvious and unavoidable conſequence.

All reducible to ſyllogiſms, of ſome one form or other.

XII. Now in all caſes of this kind where propoſitions are deduced one from another, on account of a known and evident connection, we are ſaid to reaſon by *immediate conſequence.* Such a coherence of propoſitions, manifeſt at firſt ſight, and forcing itſelf upon the mind, frequently occurs in reaſoning. Logicians have explained at ſome length the ſeveral ſuppoſitions upon which it takes place, and allow of all *immediate conſequences* that follow in conformity to them. It is however obſerveable, that theſe arguments, though ſeemingly complete, becauſe the concluſion follows neceſſarily from the ſingle propoſition that goes before, may yet be conſidered as real *enthymemes,* whoſe *major,* which is a conditional propoſition, is wanting. The ſyllogiſm but juſt mentioned, when repreſented according to this view, will run as follows:

> *If things equal to one and the ſame thing are equal to one another; theſe two triangles, each equal to a ſquare whoſe ſide is three inches, are alſo equal between themſelves.*
>
> *But things equal to one and the ſame thing, are equal to one another;*
>
> *Therefore alſo theſe triangles, &c. are equal between themſelves.*

This obſervation will be found to hold in all *immediate conſequences* whatſoever, inſomuch that they are in fact no more than *enthymemes* of hypothetical ſyllogiſms. But then it is particular to them, that the ground on which the concluſion reſts, namely, its coherence with the *minor*, is of itſelf apparent, and ſeen immediately to flow from the rules and reaſons of logic. As it is therefore entirely unneceſſary to expreſs a ſelf-evident connection, the *major*, whoſe office that is, is conſtantly omitted; nay, and ſeems ſo very little needful to enforce the concluſion, as to be accounted commonly no part of the argument at all. It muſt indeed be owned, that the foregoing *immediate conſequence* might have been reduced to a *ſimple*, as well as an *hypothetical ſyllogiſm*. This will be evident to any one who gives himſelf the trouble to make the experiment. But it is not my deſign to enter farther into theſe niceties, what has been ſaid ſufficing to ſhew, that all arguments conſiſting of but two propoſitions are real *enthymemes*, and reducible to complete ſyllogiſms of ſome one form or other. As therefore the ground on which the concluſion reſts, muſt needs be always the ſame with that of the ſyllogiſms to which they belong, we have here an univerſal criterion whereby at all times to aſcertain the juſtneſs and validity of our reaſonings in this way.

A ſorites of plain ſimple ſyllogiſms.

XIII. The next ſpecies of reaſoning we ſhall take notice of here, is what is commonly known by the name of a *ſorites*. This is a way of arguing, in which a great number of propoſitions are ſo linked together, that the predicate of one becomes continually the ſubject of the next following, until at laſt a concluſion is formed, by bringing together the ſubject of the firſt propoſition and the predicate of the laſt. Of this kind is the following argument:

God is omnipotent.
An omnipotent being can do every thing poſſible.
He that can do every thing poſſible, can do whatever involves not a contradiction:
Therefore God can do whatever involves not a contradiction.

This particular combination of propoſitions may be continued to any length we pleaſe, without in the leaſt weakening the ground upon which the concluſion reſts. The reaſon is, becauſe the *ſorites* itſelf may be reſolved into as many ſimple ſyllogiſms as there are middle terms in it; where this is found univerſally to hold, that when ſuch a reſolution is made, and the ſyllogiſms are placed in train, the concluſion of the laſt in the ſeries is alſo the concluſion of the *ſorites*. This kind of argument therefore, as it ſerves to unite ſeveral ſyllogiſms into one, muſt ſtand upon the ſame foundation with the ſyllogiſms of which it conſiſts, and is indeed, properly ſpeaking, no other than a compendious way of reaſoning ſyllogiſtically. Any one may be ſatisfied of this at pleaſure, if he but takes the trouble of reſolving the foregoing ſorites into two diſtinct ſyllogiſms; for he will there find, that he arrives at the ſame concluſion, and that too by the very ſame train of thinking, but with abundantly more words, and the addition of two ſuperfluous propoſitions.

A ſorites of hypothetical ſyllogiſms.

XIV. What is here ſaid of plain ſimple propoſitions, may be well applied to thoſe that are conditional; that is, any number of them may be ſo joined together in a ſeries, that the conſequent of one ſhall become continually the antecedent of the next following; in which caſe, by eſtabliſhing the antecedent of the firſt propoſition, we eſtabliſh the conſequent of the laſt, or by removing the laſt conſequent, remove alſo the firſt antecedent. This way of reaſoning is exemplified in the following argument:

If we love any perſon, all emotions of hatred towards him ceaſe.
If all emotion of hatred towards a perſon ceaſe, we cannot rejoice in his misfortunes.
If we rejoice not in his misfortunes, we certainly wiſh him no injury.
Therefore if we love a perſon, we wiſh him no injury.

It is evident that theſe *ſorites*, as well as the laſt, may be reſolved into a *ſeries* of diſtinct ſyllogiſms, with this only difference, that here the ſyllogiſms are all conditional. But as the concluſion of the laſt ſyllogiſm in the ſeries is the ſame with the concluſion of the *ſorites*, it is plain, that this alſo is a compendious way of reaſoning, whoſe evidence ariſes from the evidence of the ſeveral ſingle ſyllogiſms into which it may be reſolved.

The ground of reaſoning by induction.

XV. I come now to that kind of argument which logicians call *induction*; in order to the right underſtanding of which, it will be neceſſary to obſerve, that our general ideas are for the moſt part capable of various ſubdiviſions. Thus the idea of the loweſt ſpecies may be ſubdivided into its ſeveral individuals; the idea of any genus into the different ſpecies it comprehends; and ſo of the reſt. If then we ſuppoſe this diſtribution to be duly made, and ſo as to take in the whole extent of the idea to which it belongs, then it is plain that all the ſubdiviſions or parts of any idea taken together conſtitue that whole idea. Thus the ſeveral individuals of any ſpecies taken together conſtitute the whole ſpecies, and all the various ſpecies comprehended under any genus, make up the whole genus. This being allowed, it is apparent, that whatſoever may be affirmed of all the ſeveral ſubdiviſions and claſſes of any idea, ought to be affirmed of the whole general idea to which theſe ſubdiviſions belong. What may be affirmed of all the individuals of any ſpecies, may be affirmed of the whole ſpecies; and what may be affirmed of all the ſpecies of any genus, may alſo be affirmed of the whole genus; becauſe all the individuals taken together, are the ſame with the ſpecies; and all the ſpecies taken together, the ſame with the genus.

The form and ſtructure of an argument by induction.

XVI. This way of arguing, where we infer univerſally concerning any idea, what we had before affirmed or denied ſeparately of all its ſeveral ſubdiviſions and parts, is called reaſoning by *induction*. Thus, if we ſuppoſe the whole tribe of animals ſubdivided into men, beaſts, birds, inſects, and fiſhes, and then reaſon concerning them after this manner: *All men have a power of beginning motion*; *all beaſts, birds, and inſects have a power of beginning motion*; *all fiſhes have a power of beginning motion*; *therefore all animals have a power of beginning motion.* The argument is an *induction.* When the ſubdiviſions are juſt, ſo as to take in the whole general idea, and the enumeration is perfect, that is, extends to all and every of the inferior claſſes or parts, there the *induction* is complete, and the manner of reaſoning by *induction* is apparently concluſive.

The ground of argumentation in a dilemma.

XVII. The laſt ſpecies of ſyllogiſms I ſhall take notice of in this chapter, is that commonly diſtinguiſhed by the name of a *dilemma.* A *dilemma* is an argument by which we endeavour to prove the abſurdity or falſehood of ſome aſſertion. In order to this we aſſume a conditional propoſition, the antecedent of which is the aſſertion to be diſproved, and the conſequent a disjunctive propoſition, enumerating all the poſſible ſuppoſitions upon which that aſſertion can take place. If then it appears that all theſe ſeveral ſuppoſitions ought to be rejected, it is plain that the antecedent or aſſertion itſelf muſt be ſo too. When therefore ſuch a propoſition as that before mentioned is made the *major* of any ſyllogiſm, if the *minor* rejects all the ſuppoſitions contained in the conſequent, it follows neceſſarily that the concluſion ought to reject the antecedent, which, as we have ſaid, is the very aſſertion to be diſproved. This particular way of arguing, is that which logicians call a *dilemma*; and from the account here given of it, it appears that we may in general define it to be an *hypothetical ſyllogiſm where the conſequent of the major is a disjunctive propoſition, which is wholly taken away or removed in the minor.* Of this kind is the following:

If God did not create the world perfect in its kind, it muſt either proceed from want of inclination, or from want of power:
But it could not proceed either from want of inclination or from want of power;
Therefore he created the world perfect in its kind. Or, which is the ſame thing, *'Tis abſurd to ſay that he did not create the world perfect in its kind.*

An univerſal deſcription of it.

XVIII. The nature then of a *dilemma* is univerſally this. The *major* is a conditional propoſition, whoſe conſequent contains all the ſeveral ſuppoſitions upon which the antecedent can take place. As therefore theſe ſuppoſitions are wholly removed into the *minor*, it is evident that the antecedent muſt be ſo too; inſomuch that we here always argue from the removal of the conſequent to the removal of the antecedent.

That is, a *dilemma* is an argument in the *modus tollens* of hypothetical ſyllogiſms, as logicians love to ſpeak. Hence it is plain, that if the antecedent of the *major* is an affirmative propoſition, the concluſion of the *dilemma* will be negative; but if it is a negative propoſition, the concluſion will be affirmative. I cannot diſmiſs this ſubject without obſerving, that as there is ſomething very curious and entertaining in the ſtructure of a *dilemma*, ſo is it a manner of reaſoning that occurs frequently in mathematical demonſtrations. Nothing is more common with *Euclid* when about to ſhew the equality of two given figures, or which is the ſame thing, to prove the abſurdity of aſſerting them unequal; nothing, I ſay, is more common with him than to aſſume, *that if the one is not equal to the other, it muſt be either greater or leſs*: and having deſtroyed both theſe ſuppoſitions, upon which alone the aſſertion can ſtand, he thence very naturally infers, that the aſſertion itſelf is falſe. Now this is preciſely the reaſoning of a *dilemma*, and in every ſtep coincides with the frame and compoſition of that argument, as we have deſcribed it above.

CHAP. V.

Of Demonſtration.

Of reaſoning by a concatenation of ſyllogiſms.

I. HAVING diſpatched what ſeemed neceſſary to be ſaid with regard to the forms of ſyllogiſms, we now proceed to ſupply their uſe and application in reaſoning. We have ſeen that in all the different appearances they put on, we ſtill arrive at a juſt and legitimate concluſion. Now, it often happens that the concluſion of one ſyllogiſm becomes a previous propoſition in another, by which means great numbers of them are ſometimes linked together in a ſeries, and truths are made to follow one another in train. And as in ſuch a concatenation of ſyllogiſms, all the various ways of reaſoning that are truly concluſive may be with ſafety introduced, hence it is plain that, in deducing any truth from its firſt principles, eſpecially when it lies at a conſiderable diſtance from them, we are at liberty to combine all the ſeveral kinds of arguments above explained, according as they are found beſt to ſuit the end and purpoſe of our inquiries. When a propoſition is thus by means of ſyllogiſms collected from others more evident and known, it is ſaid to be *proved*; ſo that we may in the general define *the proof of a propoſition* to be a ſyllogiſm, or ſeries of ſyllogiſms, collecting that propoſition from known and evident truths. But more particularly, if the ſyllogiſms of which the proof conſiſts admit of no premiſes but definitions, ſelf-evident truths, and propoſitions already eſtabliſhed, then is the argument ſo conſtituted called a *demonſtration*; whereby it appears that demonſtrations are ultimately founded on definitions and ſelf-evident propoſitions.

All ſyllogiſms whatſoever reducible to the firſt figure.

II. But as a demonſtration often conſiſts of a long chain of proofs, where all the various ways of arguing have place, and where the ground of evidence muſt of courſe be different in different parts agreeably to the form of the argument made uſe of, it may not perhaps be unacceptable, if we here endeavour to reduce the evidence of demonſtration to one ſimple principle, whence, as a ſure and unalterable foundation, the certainty of it may in all caſes be derived. In order to this we muſt obſerve, that all ſyllogiſms whatſoever, whether compound, multiform, or defective, are reducible to plain ſimple ſyllogiſms in ſome one of the four figures. But this is not all. Syllogiſms of the firſt figure in particular, admit of all poſſible concluſions; that is, any propoſition whatſoever, whether an univerſal affirmative or univerſal negative, a particular affirmative or particular negative, which fourfold diviſion, as we have already demonſtrated in the Second Part, embraces all their varieties; any one, I ſay, of theſe may be inferred by virtue of ſome ſyllogiſm in the firſt figure. By this means it happens that the ſyllogiſms of all the other figures are reducible alſo to ſyllogiſms of the firſt figure, and may be conſidered as ſtanding on the ſame foundation with them. We cannot here demonſtrate and explain the manner of this reduction, becauſe it would too much ſwell the bulk of this Treatiſe. It is enough to take notice, that the thing is univerſally known and allowed among logicians, to whoſe writings we refer ſuch as deſire farther ſatisfaction in this matter. This then being laid down, it is plain that any demonſtration whatſoever may be conſidered as compoſed of a ſeries of ſyllogiſms, all in the firſt figure; for ſince all the ſyllogiſms that enter the demonſtration, are reduced to ſyllogiſms of ſome one of the four figures; and ſince the ſyllogiſms of all the other figures are farther reducible to ſyllogiſms of the firſt figure, it is evident that the whole demonſtration may be reſolved into a ſeries of theſe laſt ſyllogiſms. Let us now, if poſſible, diſcover the ground upon which the concluſion reſts in ſyllogiſms of the firſt figure; becauſe by ſo doing, we ſhall come at an univerſal principle of certainty, whence the evidence of all demonſtrations in all their parts may be ultimately derived.

The ground of reaſoning in the firſt figure.

III. The rules then of the firſt figure are briefly theſe. The *middle term* is the ſubject of the *major* propoſition, and the predicate of the *minor*. The *major* is always an univerſal propoſition, and the *minor* always affirmative. Let us now ſee what effect theſe rules will have in reaſoning. The *major* is an univerſal propoſition, of which the *middle term* is the ſubject, and the *predicate of the concluſion* the predicate. Hence it appears, that in the *major* the *predicate of the concluſion* is always affirmed or denied univerſally of the *middle term*. Again, The *minor* is an affirmative propoſition, whereof the *ſubject of the concluſion* is the ſubject, and the *middle term* the predicate. Here then the *middle term* is affirmed of the *ſubject of the concluſion*; that is, the *ſubject of the concluſion* is affirmed to be comprehended under, or to make a part of the *middle term*. Thus then we ſee what is done in the *premiſes* of a ſyllogiſm of the firſt figure. The *predicate of the concluſion* is univerſally affirmed or denied of ſome idea. The *ſubject of the concluſion* is affirmed to be, or to make a part of that idea. Hence it naturally and unavoidably follows, that the *predicate of the concluſion* ought to be affirmed or denied of the ſubject. To illuſtrate this by an example, we ſhall reſume one of the ſyllogiſms of the firſt chapter:

Every creature poſſeſſed of reaſon and liberty, is accountable for his actions:

Man is a creature poſſeſſed of reaſon and liberty;

Therefore man is accountable for his actions.

Here, in the firſt propoſition, the predicate of the concluſion *accountableneſs*, is affirmed of all creatures that have *reaſon and liberty.* Again, in the ſecond propoſition, *man*, The ſubject of the concluſion is affirmed to be, or to make a part of this claſs of creatures. Hence the concluſion neceſſarily and unavoidably follows, viz. *that man is accountable for his actions.* I ſay this follows neceſſarily and unavoidably; becauſe if reaſon and liberty be that which conſtitutes a creature *accountable*, and *man* has reaſon and liberty, it is plain he has that which conſtitutes him *accountable.* In like manner, where the *major* is a negative propoſition, or denies the *predicate of the concluſion* univerſally of the *middle term*, as the *minor* always aſſerts the *ſubject of the concluſion* to be or make a part of that *middle term*, it is no leſs evident that the *predicate of the concluſion* ought in this caſe to be denied of the *ſubject.* So that the ground of reaſoning in all ſyllogiſms of the firſt figure, is manifeſtly this: *Whatever may be affirmed univerſally of any idea, may be affirmed of every or any number of particulars comprehended under that idea.* And again, *Whatever may be denied univerſally of any idea, may be in like manner denied of every or any number of its individuals.* Theſe two propoſitions are called by logicians the *dictum de omni*, and *dictum de nullo*, and are indeed the great principles of ſyllogiſtic reaſoning; inaſmuch as all concluſions whatſoever, either reſt immediately upon them, or upon propoſitions deduced from them. But what adds greatly to their value is, that they are really ſelf-evident truths, and ſuch as we cannot gainſay, without running into an expreſs contradiction. To affirm, for inſtance, that *no man is perfect*, and yet argue that *ſome men are perfect*; or to ſay that *all men are mortal*, and yet that *ſome men are not mortal*, is to aſſert a thing to be and not to be at the ſame time.

Demonſtration an infallible guide to truth and certainty.

IV. And now I think we are ſufficiently authorized to affirm, that in all ſyllogiſms of the firſt figure, if the *premiſes* are true, the *concluſion* muſt needs be true. If it be true that the *predicate of the concluſion*, whether affirmative or negative, agrees univerſally to ſome idea; and if it be alſo true that the *ſubject of the concluſion* is a part of or comprehended under that idea, then it neceſſarily follows, that the *predicate of the concluſion* agrees alſo to the *ſubject*; for to aſſert the contrary, would be to run counter to ſome one of the two principles before eſtabliſhed; that is, it would be to maintain an evident contradiction. And thus we are come at laſt to the point we have been all along endeavouring to eſtabliſh, namely, that every propoſition which can be demonſtrated is neceſſarily true. For as every demonſtration may be reſolved into a ſeries of ſyllogiſms all in the firſt figure, and as in any one of theſe ſyllogiſms, if the premiſes are true, the concluſion muſt needs be ſo too, it evidently follows, that if all the ſeveral premiſes are true, all the ſeveral concluſions are ſo, and conſequently the concluſion alſo of the laſt ſyllogiſm, which is always the propoſition to be demonſtrated. Now that all the premiſes of a demonſtration are true, will eaſily appear, from the very nature and definition of that form of reaſoning. A demonſtration, as we have ſaid, is a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. Definitions are identical propoſitions, wherein we connect the deſcription of an idea with the name by which we chooſe to have that idea called; and therefore, as to their truth there can be no diſpute. Self-evident propoſitions appear true of themſelves, and leave no doubt or uncertainty in the mind. Propoſitions before eſtabliſhed, are no other than concluſions, gained by one or more ſteps from definitions and ſelf-evident principles; that is, from true premiſes, and therefore muſt needs be true. Whence all the previous propoſitions of a demonſtration, being we ſee manifeſtly true, the laſt concluſion, or propoſition to be demonſtrated, muſt be ſo too. So that demonſtration not only leads to certain truth, but we have here a clear view of the ground and foundation of that certainty; for as in demonſtrating we may be ſaid to do nothing more than combine a ſeries of ſyllogiſms together, all reſting on the ſame bottom, it is plain that one uniform ground of certainty runs through the whole, and that the concluſions are everywhere built upon ſome one of the two principles before eſtabliſhed as the foundation of all our reaſoning. Theſe two principles are eaſily reduced into one, and may be expreſſed thus: *Whatever predicate, whether affirmative or negative, agrees univerſally to any idea, the ſame muſt needs agree to every or any number of individuals comprehended under that idea.* And thus at length we have, according to our firſt deſign, reduced the certainty of demonſtration to one ſimple and univerſal principle, which carries its own evidence along with it, and which is indeed the ultimate foundation of all ſyllogiſtic reaſoning.

The rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood,

V. Demonſtration, therefore, ſerving as an infallible guide to truth, and ſtanding on ſo ſure and unalterable a baſis, we may now venture to aſſert, what I doubt not will appear a paradox to many; namely, that the rules of logic furniſh a ſufficient *criterion* for the diſtinguiſhing between truth and falſehood. For ſince very propoſition that can be demonſtrated, is neceſſarily true, he is able to diſtinguiſh truth from falſehood who can with certainty judge when a propoſition is duly demonſtrated. Now a demonſtration is, as we have ſaid, nothing more than a concatenation of ſyllogiſms, all whoſe premiſes are definitions, ſelf-evident truths, or propoſitions previouſly eſtabliſhed. To judge therefore of the validity of a demonſtration, we muſt be able to diſtinguiſh whether the definitions that enter it are genuine, and truly deſcriptive of the ideas they are meant to exhibit: whether the propoſitions aſſumed without proof as intuitive truths, have really that ſelf-evidence to which they lay claim: whether the ſyllogiſms are drawn up in due form, and agreeable to the laws of augmentation: in fine, whether they are combined together in a juſt and orderly manner, ſo that no demonſtrable propoſitions ſerve anywhere as premiſes, unleſs they are concluſions of previous ſyllogiſms. Now it is the buſineſs of logic, in explaining the ſeveral operations of the mind, fully to inſtruct us in all theſe points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the ſeveral ſpecies of propoſition, and diſtinguiſhes the ſelf-evident from the demonſtrable. It delineates alſo the different forms of ſyllogiſms, and explains the laws of argumentation proper to each. In fine, it deſcribes the manner of combining ſyllogiſms ſo as that they may form a train of reaſoning, and lead to the ſucceſſive diſcovery of truth. The precepts of logic therefore, as they enable us to judge with certainty when a propoſition is duly demonſtrated, furniſh a ſure *criterion* for the diſtinguiſhing between truth and falſehood.

and extending to all caſes where a certain knowledge of truth is attainable.

VI. But perhaps it may be objected, that demonſtration is a thing very rare and uncommon, as being the prerogative of but a few ſciences; and therefore the *criterion* here given can be of no great uſe. I anſwer, that wherever, by the bare contemplation of our ideas, truth is diſcoverable, there alſo demonſtration may be obtained. Now that I think is an abundantly ſufficient *criterion*, which enables us to judge with certainty in all caſes where the knowledge of truth comes within our reach; for with diſcoveries that lie beyond the limits of the human mind, we have properly no buſineſs nor concernment. When a propoſition is demonſtrated, we are certain of its truth. When, on the contrary, our ideas are ſuch as have no viſible connection nor repugnance, and therefore furniſh not the proper means of tracing their agreement or diſagreement, there we are ſure that knowledge, *ſcientifical* knowledge I mean, is not attainable. But where there is ſome foundation of reaſoning, which yet amounts not to the full evidence of demonſtration, there the precepts of logic, by teaching us to determine aright of the degree of proof, and of what is ſtill wanting to render it full and complete, enable us to make a due eſtimate of the meaſures of probability, and to proportion our aſſent to the grounds on which the propoſition ſtands. And this is all we can poſſibly arrive at, or even ſo much as hope for, in the exerciſe of faculties ſo imperfect and limited as ours; for it were the height of folly to expect a *criterion* that ſhould enable us to diſtinguiſh truth from falſehood, in caſes where a certain knowledge f truth is not attainable.

The diſtinction of demonſtration into direct and indirect.

VII. We have now done with what regards the ground and evidence of demonſtration; but before we conclude this chapter, it may not be improper to take notice of the diſtinction of it into *direct* and *indirect*. A *direct demonſtration* is, when beginning with definitions, ſelf-evident propoſitions, or known and allowed truths, we form a train of ſyllogiſms, and combine them in an orderly manner, continuing the ſeries thro' a variety of ſucceſſive ſteps, until at laſt we arrive at a ſyllogiſm, whoſe concluſion is the propoſition to be demonſtrated. Proofs of this kind leave no doubt or uncertainty behind them, becauſe all the ſeveral premiſes being true, the concluſions muſt be ſo too, and of courſe the very laſt concluſion or propoſition to be proved. I ſhall not therefore any farther enlarge upon this method of demonſtrating, having I hope ſufficiently explained it in the foregoing part of this chapter, and ſhewn wherein the force and validity of it lies. The other ſpecies of demonſtration is the *indirect*, or, as it is ſometimes called, the *apological*. The manner of proceeding here is by aſſuming a propoſition which directly contradicts that we mean to demonſtrate, and thence by a continued train of reaſoning, in the way of a direct demonſtration, deducing ſome abſurdity or manifeſt untruth; for hereupon we conclude that the propoſition aſſumed was falſe, and thence again by an immediate conſequence, that the propoſition to be demonſtrated is true. Thus *Euclid*, in his third book, being to demonſtrate *that circles which touch one another inwardly have not the ſame center*, aſſumes the direct contrary to this, *viz. that they have the ſame center*; and hence by an evident train of reaſoning proves, *that a part is equal to the whole*. The ſuppoſition therefore leading to the abſurdity, he concludes to be falſe, *viz. that circles touching one another inwardly have the ſame center*, and thence again immediately infers, *that they have not the ſame center*.

Ground of reaſoning in indirect demonſtrations.

VIII. Now, becauſe this manner of demonſtration is accounted by ſome not altogether ſo clear and ſatisfactory, nor to come up to that full degree of evidence which we meet with in the direct way of proof, I ſhall therefore endeavour here to give a particular illuſtration of it, and to ſhew that it equally with the other leads to truth and certainty. In order to this we muſt obſerve, that two propoſitions are ſaid to be *contradictory* one of another, when that which is aſſerted to be in the one, is aſſerted not to be in the other. Thus the propoſitions: *circles that touch one another inwardly have the ſame center*: and *circles* *that touch one another inwardly have not the ſame center*, are *contradictories*, becauſe the ſecond aſſerts the direct contrary of what is aſſerted in the firſt. Now, in all contradictory propoſitions this holds univerſally, that one of them is neceſſarily true, and the other neceſſarily falſe. For if it be true that circles which touch one another inwardly have not the ſame center, it is unavoidably falſe that they have the ſame center. On the other hand, if it be falſe that they have the ſame center, it is neceſſarily true that they have not the ſame center. Since therefore it is impoſſible for them to be both true or both falſe at the ſame time, it unavoidably follows, that one is neceſſarily true, and the other neceſſarily falſe. This then being allowed, which is indeed ſelf-evident, if any two contradictory propoſitions are aſſumed, and one of them can by a clear train of reaſoning be demonſtrated to be falſe, it neceſſarily follows that the other is true; for as the one is neceſſarily true, and the other neceſſarily falſe, when we come to diſcover which is the falſe propoſition, we thereby alſo know the other to be true.

Indirect demonſtrations a ſure guide to certainty.

IX. Now, this is preciſely the manner of an indirect demonſtration, as is evident from the account given of it above; for there we aſſume a propoſition which directly contradicts that we mean to demonſtrate; and having by a continued ſeries of proofs ſhewn it to be falſe, thence infer that its contradictory, or the propoſition to be demonſtrated, is true. As therefore this laſt concluſion is certain and unavoidable, let us next inquire, after what manner we come to be ſatisfied of the falſehood of the aſſumed propoſition, ſo that no poſſible doubt may remain as to the force and validity of demonſtrations of this kind. The manner then is plainly this: Beginning with the aſſumed propoſition, we, by the help of definitions, ſelf-evident truths, or propoſitions already eſtabliſhed, continue a ſeries of reaſoning in the way of a direct demonſtration, until at length we arrive at ſome abſurdity or known falſehood. Thus *Euclid*, in the example before mentioned, from the ſuppoſition that circles touching one another inwardly have the ſame center, deduces *that a part is equal to the whole.* Since therefore by a due and orderly proceſs of reaſoning, we come at laſt to a falſe concluſion, it is manifeſt that all the premiſes cannot be true. For were all the premiſes true, the laſt concluſion muſt be ſo too, by what has been before demonſtrated. Now, as to all the other premiſes made uſe of in the courſe of reaſoning, they are manifeſt and known truths by ſuppoſition, as being either definitions, ſelf-evident propoſitions, or truths eſtabliſhed. The aſſumed propoſition is that only as to which any doubt or uncertainty remains: that alone therefore can be falſe; and indeed from what has been already ſhewn, muſt unavoidably be ſo. And thus we ſee, that in indirect demonſtrations, two contradictory propoſitions being laid down, one of which is demonſtrated to be falſe, the other, which is always the propoſition to be proved, muſt neceſſarily be true; ſo that here, as well as in the direct way of proof, we arrive at a clear and ſatisfactory knowledge of truth.

A particular caſe of indirect demonſtration.

X. This is univerſally the method of reaſoning in all apological or indirect demonſtrations; but there is one particular caſe, which has ſomething ſo ſingular and curious in it, that well deſerves to be mentioned by itſelf; more eſpecially, as the ground on which the concluſion reſts will require ſome farther illuſtration. It is in ſhort this: that if any propoſition is aſſumed, from which in a direct train of reaſoning we can deduce its contradictory, the propoſition ſo aſſumed is falſe, and the contradictory one true. For, if we ſuppoſe the aſſumed propoſition to be true, then, ſince all the other premiſes that enter the demonſtration are alſo true, we ſhall have a ſeries of reaſoning, conſiſting wholly of true premiſes; whence the laſt concluſion, or contradictory of the aſſumed propoſition, muſt be true likewiſe; ſo that by this means we ſhould have two contradictory propoſitions both true at the ſame time; which is manifeſtly impoſſible. The aſſumed propoſition therefore whence this abſurdity flows, muſt neceſſarily be falſe, and conſequently its contradictory, which is here the propoſition deduced from it, muſt be true. If then any propoſition is propoſed to be demonſtrated, and we *aſſume* the *contradictory* of that propoſition, and thence directly infer the propoſition to be demonſtrated, by this very means we know that the propoſition ſo inferred is true. For ſince from an aſſumed propoſition we have deduced its contradictory, we are thereby certain that the aſſumed propoſition is falſe; and if ſo, then its contradictory, or that deduced from it, which in this caſe is the ſame with the propoſition to be demonſtrated, muſt be true.

A due knowledge of the principles of logic indiſpenſably neceſſary to make us proper judges of demonſtration;

XI. That this is not a mere empty ſpeculation, void of all uſe and application in practice, is evident from the conduct of the mathematicians, who have adopted this manner of reaſoning, and given it a place among their demonſtrations. We have a curious inſtance of it in the twelfth propoſition of the ninth book of the Elements. *Euclid* there propoſes to demonſtrate, *that in* *any ſeries of numbers, riſing from unity in geometrical progreſſion, all the prime numbers that meaſure the laſt term in the ſeries, will alſo meaſure the next after unity.* In order to this he aſſumes the contradictory of the propoſition to be demonſtrated, namely, *that ſome prime number meaſuring the laſt term in the ſeries, does not meaſure the next after unity*, and thence by a continued train of reaſoning proves, that it actually does meaſure it. Hereupon he concludes the aſſumed propoſition to be falſe, and that which is deduced from it, or its contradictory, which is the very propoſition he propoſed to demonſtrate, to be true. Now, that this is a juſt and concluſive way of reaſoning, is abundantly manifeſt, from what we have ſo clearly eſtabliſhed above. I would only here obſerve, how neceſſary ſome knowledge of the rules of logic is, to enable us to judge of the force, juſtneſs, and validity of demonſtrations; ſince ſuch may ſometimes occur, where the truth of the propoſition demonſtrated will neither be owned nor perceived, unleſs we know before-hand, by means of logic, that a concluſion ſo deduced is neceſſarily true and valid; for though it be readily allowed, that by the mere ſtrength of our natural faculties, we can at once diſcern that of two contradictory propoſitions, the one is neceſſarily true, and the other neceſſarily falſe; yet when they are ſo linked together in a demonſtration, as that the one ſerves as a previous propoſition, whence the other is deduced, it does not ſo immediately appear, without ſome knowledge of the principles of logic, why that alone which is collected by reaſoning, ought to be embraced as true, and the other, whence it is collected, to be rejected as falſe.

and of itſelf ſufficient to guard us againſt error and falſe reaſoning.

XII. Having thus I hope ſufficiently evinced the certainty of demonſtration in all its branches, and ſhewn the rules by which we ought to proceed, in order to arrive at a juſt concluſion, according to the various ways of arguing made uſe of, I hold it needleſs to enter upon a particular conſideration of thoſe ſeveral ſpecies of falſe reaſoning which logicians diſtinguiſh by the name of *ſophiſms*. He that thoroughly underſtands the form and ſtructure of a good argument, will of himſelf readily diſcern every deviation from it. And although *ſophiſms* have been divided into many claſſes, which are all called by ſounding names, that therefore carry in them much appearance of learning, yet are the errors themſelves ſo very palpable and obvious, that I ſhould think it loſt labour to write for a man capable of being miſled by them. Here therefore we chooſe to conclude this third part of logic, and ſhall in the next book give ſome account of *method*, which, though inſeparable from reaſoning, is nevertheleſs always conſidered by logicians as a diſtinct operation of the mind; becauſe its influence is not confined to the mere exerciſe of the reaſoning faculty, but extends in ſome degree to all the tranſactions of the underſtanding.

THE
ELEMENTS OF LOGIC.

BOOK IV.

OF METHOD.

CHAP. I.

Of Method in general, and the Diviſion of it into Analytic and Synthetic.

The underſtanding ſometimes employed in putting together known truths.

I. WE have now done with the three firſt operations of the mind, whoſe office it is to ſearch after truth, and enlarge the bounds of human knowledge. There is yet a fourth which regards the diſpoſal and arrangement of our thoughts, when we endeavour ſo to put them together, that their mutual connection and dependence may be clearly ſeen. This is what logicians call *method*, and place always the laſt in order in explaining the powers of the underſtanding, becauſe it neceſſarily ſuppoſes a previous exerciſe of our other faculties, and ſome progreſs made in knowledge, before we can exert it in any extenſive degree. It often happens in the purſuit of truth, that unexpected diſcoveries preſent themſelves to the mind, and thoſe too relating to ſubjects very remote from that about which we are at preſent employed. Even the ſubjects themſelves of our inquiry are not always choſen with a due regard to order and their dependence one upon another. Chance, our particular way of life, or ſome preſent and preſſing views, often prompt us to a variety of reſearches that have but little connection in the nature of things. When therefore a man accuſtomed to much thinking comes, after any conſiderable interval of time, to take a ſurvey of his intellectual acquiſitions, he ſeldom finds reaſon to be ſatisfied with that order and diſpoſition according to which they made their entrance into his underſtanding. They are there diſperſed and ſcattered, without ſubordination, or any juſt and regular coherence; inſomuch that the ſubſerviency of one truth to the diſcovery of another does not ſo readily appear

In this nothing can be ſuperior to the mathematicks for there if you try to find the conſequent truth you must be, regularly Master of all the antecedent ones.

to the mind. Hence he is convinced of the neceſſity of diſtributing them into various claſſes, and combining into an uniform ſyſtem whatever relates to one and the ſame ſubject. Now this is the true and proper buſineſs of *method*; to aſcertain the various diviſions of human knowledge, and ſo to adjuſt and connect the parts in every branch, that they may ſeem to grow one out of another, and form a regular body of ſcience, riſing from firſt principles, and proceeding by an orderly concatenation of truths.

Sometimes in the ſearch and diſcovery of ſuch as are unknown.

II. In this view of things, it is plain that we muſt be before hand well acquainted with the truths we are to combine together, otherwiſe how could we diſcern their ſeveral connections and relations, or ſo diſpoſe of them as their mutual dependence may require? But now it often happens the underſtanding is employed, not in the arrangement and compoſition of known truths, but in the ſearch and diſcovery of ſuch as are unknown. And here the manner of proceeding is very different, inaſmuch as we aſſemble at once our whole ſtock of knowledge relating to any ſubject, and after a general ſurvey of things, begin with examining them ſeparately and by parts. Hence it comes to paſs, that whereas at our firſt ſetting out we were acquainted only with ſome of the grand ſtrokes

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and outlines, if I may ſo ſay of Truth, by thus purſuing her through her ſeveral windings and receſſes, gradually diſcover thoſe more inward and finer touches, whence ſhe derives all her ſtrength, ſymmetry, and beauty. And here it is that, when by a narrow ſcrutiny into things, we have unravelled any part of knowledge, and traced it to its firſt and original principles, inſomuch that the whole frame and contexture of it lies open to the view of the mind; here I ſay it is, that taking it the contrary way, and beginning with theſe principles, we can ſo adjuſt and put together the parts as the order and method of ſcience requires.

Illuſtrated by the ſimilitude of a watch.

III. But as theſe things are beſt underſtood when illuſtrated by examples, eſpecially if they are obvious and taken from common life, let us ſuppoſe any machine (for inſtance a watch) preſented to us, whoſe ſtructure and compoſition we are as yet unacquainted with, but want if poſſible to diſcover. The manner of proceeding in this caſe is by taking the whole to pieces, and examining the parts ſeparately one after another. When by ſuch a ſcrutiny we have thoroughly informed ourſelves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and compoſition of the whole, and come at length to diſcern how parts of ſuch a form, and ſo put together as we found, in unravelling and taking them aſunder, conſtitute that particular machine called a watch, and contribute to all the ſeveral motions and phænomena obſervable in it. This diſcovery being made, we can take things the contrary way, and beginning with the parts, ſo diſpoſe and connect them as their ſeveral uſes and ſtructures require, until at length we arrive at the whole itſelf, from the unravelling of which theſe parts reſulted.

Ground of the analytic and ſynthetic methods.

IV. And as it is in tracing and examining the works of art, ſo it is in a great meaſure in unfolding any part of human knowledge; for the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourſe to intermediate ideas, and by means of them are furniſhed with thoſe previous propoſitions that lead to the concluſion we are in queſt of. And if it ſo happen that the previous propoſitions themſelves are not ſufficiently evident, we endeavour by new middle terms to aſcertain their truth, ſtill tracing things backward in a continued ſeries, until at length we arrive at ſome ſyllogiſm where the premiſes are firſt and ſelf-evident principles. This done, we become perfectly ſatisfied as to the truth of all the concluſions we have paſſed through, inaſmuch as they are now ſeen to ſtand upon the firm and immoveable foundation of our intuitive perceptions. And as we arrived at this certainty by tracing things backward to the original principles whence they flow, ſo may we at any time renew it by a direct contrary proceſs, if beginning with theſe principles we carry the train of our thoughts forward, until they lead us by a connected chain of proofs to the very laſt concluſion of the ſeries.

Diviſion of method into analytic and ſynthetic.

V. Hence it appears, that in diſpoſing and putting together our thoughts, either for our own uſe, that the diſcoveries we have made may at all times lie open to the review of the mind; or where we mean to communicate and unfold theſe diſcoveries to others, there are two ways of proceeding equally within our choice. For we may ſo propoſe the truths relating to any part of knowledge as they preſented themſelves to the mind in the manner of inveſtigation, carrying on the ſeries of proofs in a reverſe order, until they at laſt terminate in firſt principles; or beginning with theſe principles, we may take the contrary way, and from them deduce, by a direct train of reaſoning, all the ſeveral propoſitions we want to eſtabliſh. This diverſity in the manner of arranging our thoughts, gives riſe to the twofold diviſion of method eſtabliſhed among logicians; for method, according to their uſe of the word, is nothing elſe but the order and diſpoſition of our thoughts relating to any ſubject. When truths are ſo propoſed and put together as they were or might have been diſcovered, this is called the *analytic method*, or the *method of reſolution*; inaſmuch as it traces things backward to their ſource, and *reſolves* knowledge into its firſt and original principle. When, on the other hand, they are deduced from theſe principles, and connected according to their mutual dependence, inſomuch that the truths firſt in order tend always to the demonſtration of thoſe that follow, this conſtitutes what we call the *ſynthetic method*, or *method of compoſition*. For here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and *combining* them into one whole or ſyſtem, in ſuch manner that the underſtanding is enabled diſtinctly to follow truth through all her different ſtages and gradations.

Called otherwiſe the method of invention and the method of ſcience.

VI. There is this farther to be taken notice of in relation to theſe two ſpecies of method, that the firſt has alſo obtained the name of the *method of invention*, becauſe it obſerves the order in which our thoughts ſucceed one another in the *invention* or diſcovery of truth. The other again is often denominated the *method of doctrine* or *inſtruction*, inaſmuch as in laying our thoughts before others, we generally chooſe to proceed in the *ſynthetic* manner, deducing them from their firſt principles. For we are to obſerve, that although there is great pleaſure in purſuing truth in the method of inveſtigation, becauſe it places us in the condition of the inventor, and ſhews the particular train and proceſs of thinking by which he arrived at his diſcoveries, yet it is not ſo well accommodated to the purpoſes of evidence and conviction ; for at our firſt ſetting out we are commonly unable to divine where the analyſis will lead us, inſomuch that our reſearches are for ſome time little better than a mere groping in the dark : and even after light begins to break in upon us, we are ſtill obliged to many reviews, and a frequent compariſon of the ſeveral ſteps of the inveſtigation among themſelves. Nay, when we have unravelled the whole, and reached the very foundation on which our diſcoveries ſtand, all our certainty in regard to their truth will be found in a great meaſure to ariſe from that connection we are now able to diſcern between them and firſt principles, taken in the order of compoſition. But in the ſynthetic manner of diſpoſing our thoughts, the caſe is quite different ; for as we here begin with intuitive truths, and advance by regular deductions from them, every ſtep of the procedure brings evidence and conviction along with it ; ſo that in our progreſs from one part of knowledge to another, we have always a clear perception of the ground on which our aſſent reſts. In communicating therefore our diſcoveries to others, this method is apparently to be choſen, as it wonderfully improves and enlightens the underſtanding, and leads to an immediate perception of truth. And hence it is that, in the following pages, we chooſe to diſtinguiſh it by the name of the *method of ſcience* ; not only as in the uſe of it we arrive at *ſcience* and certainty, but becauſe it is in fact the method in which all thoſe parts of human knowledge that properly bear the name of *ſciences*, are and ought to be delivered. But we now proceed to explain theſe two kinds of method more particularly.

CHAP. II.

Of the Method of Invention.

Origin of the ſeveral arts and inventions of human life.

I. BY the *method of invention* we underſtand ſuch a diſpoſition and arrangement of our thoughts as follows the natural procedure of the underſtanding, and preſents them in the order in which they ſucceed one another in the inveſtigation and diſcovery of truth. Now it is plain, that to handle a ſubject ſucceſsfully according to this method, we have no more to do than obſerve the ſeveral ſteps and advances of our minds, and fairly copy them out to the view of others. And indeed it will be found to hold in general, with regard to all the active parts of human life, eſpecially when reduced to that which is in the ſchools termed an art, that the rules by which we conduct ourſelves are no other than a ſeries of obſervations drawn from the attention of the mind to what paſſes, while we exerciſe our faculties in that particular way; for when we ſet about any invention or diſcovery, we are always puſhed on by ſome inward principle, diſpoſition, or aptitude (ſhall I call it?) which we experience in ourſelves, and which makes us believe that the thing we are in queſt of is not altogether beyond our reach. We therefore begin with eſſaying our ſtrength, and are ſometimes ſucceſsful, though perhaps more frequently not. But as the mind, when earneſtly bent upon any purſuit, is not eaſily diſcouraged by a few diſappointments, we are only ſet upon renewing our endeavours, and by an obſtinate perſeverance and repeated trials, often arrive at the diſcovery of what we have in view. Now it is natural for a man of a curious and inquiſitive turn, after having maſtered any part of knowledge with great labour and difficulty, to ſet himſelf to examine how he happened to miſcarry in his firſt attempts, and by what particular method of procedure he at length came to be ſucceſsful. By this means we diſcover, on the one hand, thoſe rocks and ſhelves which ſtand moſt in our way, and are apt to diſturb and check our progreſs; and, on the other, that more ſure and certain courſe, which if we continue in ſteadily, will bring us to the attainment of what we are in purſuit of. Hence ſpring all the arts and inventions of human life, which, as we have already ſaid, are founded upon a ſeries of rules and obſervations, pointing out the true and genuine manner of arriving at any attainment. When the mind reſts ſatisfied in a bare contemplation of the rules, and the reaſons on which they are founded, this kind of knowledge is called Speculative. But if we proceed farther, and endeavour to apply theſe rules to practice, ſo as to acquire a habit of exerting them on all proper occaſions, we are then ſaid to be poſſeſſed of the art itſelf.

Why, in treating of the method of invention, we muſt give ſome account of the art itſelf.

II. From what has been ſaid, it appears that, in order diſtinctly to explain the method of invention, we muſt take a view of the underſtanding as employed in the ſearch and inveſtigation of truth; for by duly attending to its procedure and advances, we ſhall not only diſcover the rules by which it conducts itſelf, but be enabled alſo to trace out the ſeveral helps and contrivances it makes uſe of for the more ſpeedy and effectual attainment of its ends: and when theſe particulars are once known, it will not be difficult for us, in laying open our diſcoveries to others, to combine our thoughts agreeably to the method here required; becauſe, having fixed and aſcertained the rules of it, and being perfectly acquainted with the conduct and manner of the mind, we need only take a review of the ſeveral truths as they ſucceed one another in the ſeries of inveſtigation, ſet them in order before us, and fairly tranſcribe the appearance they make to the underſtanding. Hence it is that logicians, in treating of the method of invention, have not merely confined themſelves to the laying down of directions for the diſpoſal and arrangement of our thoughts, but have rather explained the art itſelf, and eſtabliſhed thoſe rules by which the mind ought to proceed in the exerciſe of its inventive powers; for they rightly judged, that if theſe were once thoroughly underſtood, the other could no longer remain unknown. By this means it happens that the *method of invention* is become another expreſſion for the *art of invention*, and very often denotes the conduct and procedure of the underſtanding in the ſearch of truth: and as ſome knowledge of the principles of the art is in a manner abſolutely neceſſary towards a true conception of the rules by which we ought to govern and diſpoſe our thoughts in treating ſubjects after this method, we ſhall therefore follow the example of other logicians, and endeavour to give ſome ſhort account of the buſineſs of invention, and of thoſe ſeveral helps and contrivances by which the mind is enabled to facilitate and enlarge its diſcoveries.

Attention and a comprehenſive underſtanding the preparatory qualifications to invention.

III. It has been already obſerved, that when the mind employs itſelf in the ſearch of unknown truths, it begins with aſſembling at once its whole ſtock of knowledge relating to the ſubject; and after a general ſurvey of things, ſets about examining them ſeparately and by parts. Now, as in this ſeparate examination, the number of parts continually increaſe upon us; and as it is farther neceſſary that we ſurvey them on all ſides, compare them one with another, and accurately trace their mutual habitudes and reſpects, it is from hence apparent that, in the exerciſe of invention, two things are of principal conſideration.

Firſt, An enlarged and comprehenſive underſtanding, able to take in the great multitude of particulars that frequently come under our notice. Secondly, A ſtrong habit of attention, that lets nothing remarkable ſlip its view, and diſtinguiſhes carefully all thoſe circumſtances which tend to the illuſtrating and clearing the ſubject we are upon. Theſe are the great and preparatory qualifications, without which it were in vain to hope that any conſiderable advance could be made in enlarging the bounds of human knowledge: nor ought we to eſteem it a ſmall advantage that they are in ſome meaſure in our own power, and may, by a proper cultivation, be improved and ſtrengthened to a degree almoſt beyond belief. We find by experience, that the ſtudy of mathematics in particular is greatly ſerviceable to this end. Habits we all know grow ſtronger by exerciſe, and as in this ſcience there is a perpetual call upon our attention, it by degrees becomes natural to us, ſo as that we can preſerve it ſteady and uniform through long and intricate calculations, and that with little or no fatigue to the underſtanding. But a yet more wonderful advantage ariſing from the culture of the mathematics is this, that hereby we in ſome meaſure extend the dimenſions of the human mind, enlarge its compaſs of perception, and accuſtom it to wide and comprehenſive views of things. For whereas at our firſt ſetting out, we often find it extremely difficult to maſter a ſhort and eaſy demonſtration, and trace the connection of its ſeveral parts, yet as we advance in the ſcience, the underſtanding is ſeen gradually to dilate, and ſtretch itſelf to a greater ſize; inſomuch that a long and intricate ſeries of reaſoning is often taken in with ſcarce any labour of thought; and not only ſo, but we can in ſome caſes, with a ſingle glance of our minds, run through an entire ſyſtem of truths, and extend our view at once to all the ſeveral links that unite and hold them together.

A judicious choice of intermediate ideas another great requiſite in this art.

IV. When we are furniſhed with theſe two preparatory qualifications, the next requiſite to the diſcovery of truth is, a judicious choice of intermediate ideas. We have ſeen in the third part of this treatiſe, that many of our ideas are of ſuch a nature as not to diſcover their ſeveral habitudes and relations by any immediate compariſon one with another. In this caſe we muſt have recourſe to intermediate ideas; and the great art lies in finding out ſuch as have an obvious and perceivable connection with the ideas whoſe relations we enquire after; for thus it is that we are furniſhed with known and evident truths, to ſerve as premiſes for the diſcovery of ſuch as are unknown: and indeed the whole buſineſs of invention ſeems in a great meaſure to lie in the due aſſemblage and diſpoſition of theſe preliminary truths; for they not only lead us ſtep by ſtep to the diſcovery we are in queſt of, but are ſo abſolutely neceſſary in the caſe, that without them it were in vain to attempt it; nothing being more certain than that unknown propoſitions can no otherwiſe be traced but by means of ſome connection they have with ſuch as are known. Nay, reaſon itſelf, which is indeed the art of knowledge, and the faculty by which we puſh on our diſcoveries, yet by the very definition of it, implies no more than an ability of deducing unknown truths from principles or propoſitions that are already known. Now although this happy choice of intermediate ideas, ſo as to furniſh a due train of previous propoſitions, that ſhall lead as ſucceſſively from one diſcovery to another, depends in ſome meaſure upon a natural ſagacity and quickneſs of mind, it is yet certain from experience, that even here much may be effected by a ſtubborn application and induſtry. In order to this, it is in the firſt place neceſſary that we have an extenſive knowledge of things, and ſome general acquaintance with the whole circle of arts and ſciences. Wide and extended views add great force and penetration to the mind, and enlarge its capacity of judging. And if to this we join, in the ſecond place, a more particular and intimate ſtudy of whatever relates to the ſubject about which our enquiries are employed, we ſeem to bid fair for ſucceſs in our attempts; for thus we are provided with an ample variety out of which to chooſe our intermediate ideas, and are therefore more likely to diſcover ſome among them that will furniſh out the previous propoſitions neceſſary in any train of reaſoning.

Sagacity and a quickneſs of underſtanding greatly promoted by the ſtudy of algebra.

V. It is not indeed to be denied, that when we have even got all our materials about us, much ſtill depends upon a certain dexterity and addreſs, in ſingling out the moſt proper, and applying them ſkilfully for the diſcovery of truth. This is that talent which is known by the name of Sagacity, and commonly ſuppoſed to be altogether the gift of nature. But yet I think it is beyond diſpute, that practice, experience, and a watchful attention to the procedure of our own minds while employed in the exerciſe of reaſoning, are even here of very great avail. It is a truth well known to thoſe who have made any conſiderable progreſs in the ſtudy of algebra, that an addreſs and ſkill in managing intricate queſtions may be very often obtained, by a careful imitation of the beſt models. For although when we firſt ſet out about the ſolution of equations, we are puzzled at every ſtep, and think we can never enough admire the ſagacity of thoſe who preſent us with elegant models in that way, yet by degrees we ourſelves arrive at a great maſtery, not only in deviſing proper equations, and coupling them artfully together, ſo as from the more complicated to derive others that are ſimple, but alſo in contriving uſeful ſubſtitutions, to free our calculations from fractions, and thoſe intricacies that ariſe from ſurds and irrational quantities. Nor is it a ſmall pleaſure attending the proſecution of this ſtudy, that we thus diſcern the growing ſtrength of our own minds, and ſee ourſelves approaching nearer and nearer to that ſagacity and quickneſs of underſtanding which we ſee ſo much admired in others, and were at firſt apt to conclude altogether beyond our reach.

Where art and management are required in the buſineſs of invention.

VI. We have now conſidered thoſe requiſites to invention that have their foundation in the natural talents of the mind: an enlarged and comprehenſive underſtanding, a ſtrong habit of attention, a ſagacity and quickneſs in diſcerning and applying intermediate ideas; let us next take a view of ſuch other helps as more immediately depend upon art and management, and ſhew

algebra may be term'd the whet-
-stone of thinking. —

the addreſs of the mind, in contriving means to faciliate its diſcoveries, and free it from all unneceſſary fatigue and labour. For we are to obſerve, that tho' the capacity of the intellect may be greatly enlarged by uſe and exerciſe, yet ſtill our views are confined within certain bounds, beyond which a finite underſtanding cannot reach: and as it often happens in the inveſtigation of truth, eſpecially where it lies at a conſiderable diſtance from the firſt principles, that the number of connections and relations are ſo great, as not to be taken in at once by the moſt improved underſtanding, it is therefore one great branch of the art of invention, to take account of theſe relations as they come into view, and diſpoſe of them in ſuch manner, that they always lie open to the inſpection of the mind, when diſpoſed to turn its attention that way. By this means, without perplexing ourſelves with too many conſiderations at once, we have yet theſe relations at command, when neceſſary to be taken notice of in the proſecution of our diſcoveries; and the underſtanding thus free and diſengaged, can bend its powers more intenſely towards that particular part of the inveſtigation it is at preſent concerned with. Now in this, according to my apprehenſion, lies the great art of human knowledge; to manage with ſkill the capacity of the intellect, and contrive ſuch helps as may bring the moſt wide and extended objects within the compaſs of its natural powers. When therefore the multitude of relations increaſe very faſt upon us, and grow too unwieldy to be dealt with in the lump, we muſt combine them in different claſſes, and ſo diſpoſe of the ſeveral parts, as that they may at all times lie open to the leiſurely ſurvey of the mind. By this means we avoid perplexity and confuſion, and are enabled to conduct our reſearches without being puzzled with that infinite crowd of particulars that frequently fall under our notice in long and difficult inveſtigations; for by carrying our attention ſucceſſively from one part to another, we can upon occaſion take in the whole; and knowing alſo the order and diſpoſition of the parts, may have recourſe to any of them at pleaſure, when its aid becomes neceſſary in the courſe of our inquiries.

An orderly diſpoſition of great uſe in adapting objects to the capacity of the underſtanding.

VII. Firſt then I ſay, that an orderly combination of things, and claſſing them together with art and addreſs, brings great and otherwiſe unmanageable objects upon a level with the powers of the mind. We have ſeen in the Firſt Part of this Treatiſe, how by taking numbers in a progreſſive ſeries, and according to an uniform law of compoſition, the moſt bulky and formidable collections are comprehended with eaſe, and leave diſtinct impreſſions in the underſtanding; for the ſeveral ſtages of the progreſſion ſerve as ſo many ſteps to the mind, by which it aſcends gradually to the higheſt combinations; and as it can carry its views from one to another with great eaſe and expedition, it is thence enabled to run over all the parts ſeparately, and thereby riſe to a juſt conception of the whole. The ſame thing happens in all our other complex notions, eſpecially when they grow very large and complicated: for then it is that we become ſenſible of the neceſſity of eſtabliſhing a certain order and gradation in the manner of combining the parts. This has been already explained at ſome length in the chapter of the Compoſition and Reſolution of our Ideas, where we have traced the gradual progreſs of the mind through all the different orders of perception, and ſhewn that the moſt expeditious way of arriving at a juſt knowledge of the more compounded notices of the underſtanding, is by advancing regularly through all the intermediate ſteps. Hence it is eaſy to perceive what advantages muſt ariſe from a like conduct in regard to thoſe ſeveral relations and connections upon which the inveſtigation of truth depends; for as by this means we are enabled to bring them all within the reach of the mind, they can each in their turns be made uſe of upon occaſion, and furniſh their aſſiſtance towards the diſcovery of what we are in queſt of. Now this is of principal conſideration in the buſineſs of invention, to have our thoughts ſo much under command, that in comparing things together, in order to diſcover the reſult of their mutual connections and dependence, all the ſeveral lights that tend to the clearing the ſubject we are upon, may lie diſtinctly open to the underſtanding, ſo as nothing material ſhall eſcape its view; becauſe an overſight of this kind in ſumming up the account, muſt not only greatly retard its advances, but in many caſes check its progreſs altogether.

and in enabling us to proceed gradually, and with eaſe, in the inveſtigation of truth.

VIII. But ſecondly, Another advantage ariſing from this orderly diſpoſition is, that hereby we free the mind from all unneceſſary fatigue, and leave it to fix its attention upon any part ſeparately without perplexing itſelf with the conſideration of the whole. Unknown truths, as we have already obſerved, are only to be traced by means of the relation between them and others that are known. When therefore theſe relations become very numerous, it muſt needs greatly diſtract the mind, were it to have its attention continually upon the ſtretch after ſuch a multitude of particulars at once. But now, by the method of claſſing and ordering our perceptions above explained, this inconvenience is wholly prevented; for a juſt diſtribution of things, as it aſcertains diſtinctly the place of each, enables us to call any of them into view at pleaſure when the preſent conſideration of it becomes neceſſary. Hence the mind, proceeding gradually through the ſeveral relations of its ideas, and marking the reſults of them at every ſtep, can always proportion its inquiries to its ſtrength; and confining itſelf to ſuch a number of objects as it can take in and manage with eaſe, ſees more diſtinctly all the conſequences that ariſe from comparing them one with another. When therefore it comes afterwards to take a review of theſe its ſeveral advances, as by this means the amount of every ſtep of the inveſtigation is fairly laid open to its inſpection, by adjuſting and putting theſe together in due order and method, it is enabled at laſt to diſcern the reſult of the whole; and thus, as before in the compoſition of our ideas, ſo likewiſe here in the ſearch and diſcovery of truth, we are fain to proceed gradually, and by a ſeries of ſucceſſive ſtages; for theſe are ſo many reſting places to the mind, whence to look about it, ſurvey the concluſions it has already gained, and ſee what helps they afford towards the obtaining of others, which it muſt ſtill paſs through before it reaches the end of the inveſtigation. Hence it often happens, that very remote and diſtant truths, which lie far beyond the reach of any ſingle effort of the mind, are yet by this progreſſive method ſucceſsfully brought to light, and that too with leſs fatigue to the underſtanding than could at firſt have well been imagined; for although the whole proceſs, taken together, is frequently much too large to come within the view of the mind at once, and therefore conſidered in that light may be ſaid truly to exceed its graſp, yet the ſeveral ſteps of the inveſtigation by themſelves are often eaſy and manageable enough; ſo that by proceeding gradually from one to another, and thoroughly maſtering the parts as we advance, we carry on our reſearches with wonderous diſpatch, and are at length conducted to that very truth, with a view to the diſcovery of which the inquiſition itſelf was ſet on foot.

Algebra and arithmetic, properly ſpeaking, both arts of invention.

IX. But now perhaps it may not be improper, if we endeavour to illuſtrate theſe obſervations by an example, and ſet ourſelves to trace the conduct and manner of the mind, when employed in the exerciſe of invention. There are two great branches of the mathematics peculiarly fitted to furniſh us with models in this way: *Arithmetic* I mean, and *algebra*. Algebra is univerſally known to be the very art and principle of invention; and in arithmetic too, we are frequently put upon the finding out of unknown numbers, by means of their relations and connections with others that are known; as where it is required to find a number equal to this ſum of two others, or the product of two others. I chooſe to borrow my examples chiefly from this laſt ſcience, both becauſe they will be more within the reach of thoſe for whom this Treatiſe is principally deſigned; as likewiſe becauſe arithmetic furniſhes the beſt models of a happy ſagacity and management in claſſing and regulating our perceptions. So that here, more than in any other branch of human knowledge, we ſhall have an opportunity of obſerving how much an orderly diſpoſition of things tends to the eaſe and ſucceſs of our inquiries, by leaving us to canvaſs the parts ſeparately, and thereby riſe to a gradual conception of the whole without entangling ourſelves with too many conſiderations at once in any ſingle ſtep of the inveſtigation. For it will indeed be found, that a dexterity and addreſs in the uſe of this laſt advantage, ſerves to facilitate and promote our diſcoveries, almoſt beyond imagination or belief.

The method of claſſing our perceptions in arithmetic.

X. We have already explained the manner of reducing numbers into claſſes, and of diſtinguiſhing theſe claſſes by their ſeveral names. And now we are farther to obſerve, that the preſent method of notation is ſo contrived, as exactly to fall in with this form of numbering; for as in the names of numbers we riſe from *units* to *tens*, from *tens* to *hundreds*, from *hundreds* to *thouſands*, *&c.* ſo likewiſe in their notation, the ſame figures, in different places, ſignify theſe ſeveral combinations. Thus, 2 in the firſt place on the right hand, denotes two *units*; in the ſecond place, it expreſſes ſo many *tens*; in the third, *hundreds*; in the fourth, *thouſands*. By this means it happens, that when a number is written down in figures, as every figure in it expreſſes ſome diſtinct combination, and all theſe combinations together make up the total ſum, ſo may the ſeveral figures be conſidered as the conſtituent parts of the number. Thus the number 2436, is evidently by the very notation diſtinguiſhed into four parts, marked by the four figures that ſerve to expreſs it; for the firſt denotes *two thouſand*, the ſecond *four hundred*, the third *thirty* or *three tens*, and the fourth *ſix*. Theſe ſeveral parts, tho' they here appear in a conjoined form, may yet be alſo expreſſed ſeparately thus: 2000, 400, 30, and 6; and the amount is exactly the ſame.

The helps thence derived towards an eaſy addition of numbers.

XI. This then being the caſe, if it is required to find a number equal to the ſum of two others given, our buſineſs is to examine ſeparately theſe given numbers, and if they appear too large and bulky to be dealt with by a ſingle effort of thought, then, ſince the very notation diſtinguiſhes them into different parts, we muſt content ourſelves with conſidering the parts aſunder, and finding their ſums one after another; for ſince the whole is equal to all its parts, if we find the ſums of the ſeveral parts of which any two numbers conſiſt, we certainly find the total ſum of the two numbers. And therefore theſe different ſums, united and put together according to the eſtabliſhed rules of notation, will be the very number we are in queſt of. Let it be propoſed, for inſtance, to find a number equal to the ſum of theſe two, 2436 and 4352. As the finding of this by a ſingle effort of thought would be too violent an exerciſe for the mind, I conſider the figures repreſenting theſe numbers as the parts of which they conſiſt, and therefore ſet myſelf to diſcover their ſums one after another. Thus 2, the firſt figure on the right hand of the one, added to 6, the firſt figure on the right hand of the other, make 8; which is therefore the ſum of theſe two parts. Again, the ſum of 5 and 3, the two figures or parts in the ſecond place, is likewiſe 8. But now as figures in the ſecond place denote not ſimple *units* but *tens*, hence it is plain that 5 and 3 here ſignify five *tens* and three *tens*, or 50 and 30, whoſe ſum therefore muſt be eight *tens*, or 80.

And here again I call to mind, that having already obtained one figure of the ſum, if I place that now found immediately after it, it will thereby ſtand alſo in the ſecond place, and ſo really expreſs, as it ought to do, eight *tens*, or 80. And thus it is happily contrived, that tho' in the addition of the *tens*, I conſider the figures compoſing them as denoting only ſimple *units*, which makes the operation eaſier and leſs perplexed, yet, by the place their ſum obtains in the number found, it expreſſes the real amount of the parts added, taken in their full and complete values. The ſame thing happens in ſumming the *hundreds* and *thouſands*; that is, though the figures expreſſing theſe combinations are added together as ſimple units, yet their ſums, ſtanding in the third and fourth places of the number found, thereby really denote the hundreds and thouſands, and ſo repreſent the true value of the parts added.

Becauſe in the ſeveral ſteps by which it is carried on, the mind is put to little or no fatigue.

XII. Here then we have a manifeſt proof of the great advantages derived from an artful method of claſſing our perceptions; for as the numbers themſelves are by this means diſtinguiſhed into different parts, which brings them more readily within the compaſs of the underſtanding, ſo by taking theſe parts ſeparately, the operations about numbers are rendered very eaſy and ſimple. And indeed it is particularly worthy our notice, and tho' in adding two very large numbers together, the whole proceſs is of ſufficient length, yet the ſeveral ſteps by which it is conducted, are managed with incredible diſpatch, and ſcarce any fatigue to the mind. This is apparent in the example given above, where we ſee, that in every advance from one part to another, nothing more is required than to add together the two figures in the like places of the numbers to be ſummed. But what it yet more wonderful, tho' in the progreſs of a long operation the figures riſe in their value as we advance, and grow to ſignify *thouſands*, *millions*, *billions*, *&c.* yet ſo happily are they contrived for expreſſing the different parts of numbers, that in every ſtep of the procedure we conſider them as denoting only ſimple units, all other deficiencies being made up by the places their ſums obtain in the total amount. And thus it is ſo ordered in this admirable form of notation, that however large the numbers are that come under examination, they are nevertheleſs managed with the ſame eaſe as the moſt ſimple and obvious collections; becauſe in the ſeveral operations about them, the mind is neither tied down to the view of too many parts at once, nor entangled with any conſiderations regarding the bulk and compoſition of thoſe parts.

This farther illuſtrated by an example in multiplication.

XIII. And if theſe advantages are ſo very manifeſt in the firſt and ſimpleſt rules of arithmetic, much more do they diſcover themſelves in thoſe that are intricate and complex. Let a man endeavour in his thoughts to find the product of two numbers, each conſiſting of twenty or thirty places, and that without conſidering the parts ſeparately, I believe he will ſoon be ſenſible that it is a diſcovery far beyond the limits of the human mind. But now in the progreſſive method above explained, nothing is more ſimple and eaſy. For if we take the firſt figure on the right hand of the one number, and by it multiply every figure of the other ſeparately, theſe ſeveral products, connected according to the eſtabliſhed laws of notation, muſt truly repreſent the total product of this other, by that part of the multiplying number. Let us ſuppoſe, for inſtance, the figure in the unit's place of the *multiplier* to be 2, and the three laſt places of the *multiplicand* to be 432: then, 2 multiplying 2 produces 4, which therefore is the firſt part of the product. Again, 2 multiplying 3 produces 6. But now 3 ſtanding in the ſecond place of the multiplicand, denotes in its real value three *tens*, or 30, which therefore taken twice, amounts to ſix *tens* or 60.

And accordingly the figure 6, coming after 4 already found, is thereby thrown into the ſecond place of the product, and ſo truly expreſſes 60, its full and adequate value. The ſame thing happens in multiplying 4, which ſtanding in the place of *hundreds*, its product by 2 is 800. But this very ſum the figure 8, produced from 2 and 4, really denotes in the total product; becauſe, coming after 64, the two parts already found, it is thereby determined to the third place, where it of courſe expreſſes ſo many *hundreds*. This proceſs, as is evident, may be continued to any length we pleaſe; and it is remarkable that, in like manner as in addition, though the value of the figures in the multiplicand continually riſes upon us, yet we all along proceed with them as ſimple units; becauſe the places of the ſeveral products in the total amount, repreſent the juſt reſults of multiplying the figures together, according to their true and adequate value.

Of the diſpoſition of the ſeveral products in order to addition.

XIV. Having thus obtained the product by the firſt figure of the multiplier, we next take that in the ſecond place, and proceed with it in the ſame manner. This ſecond operation gives us the effect of that figure, conſidered as a ſimple digit. But as it ſtood in the ſecond place, and therefore really denoted ſo many *tens*, hence it is plain that the product now gained muſt be yet multiplied by *ten*, in order to expreſs the true product ſought. This is accordingly done in the operation, by placing the firſt figure of this ſecond product under the ſecond figure of the firſt product; for this, when they come to be added together, has the ſame effect as annexing a cypher, or multiplying by *ten*, as every one knows who is in the leaſt acquainted with the rules of arithmetic. In like manner, when we multiply by the figure in the third place, as this new product is placed ſtill one figure backwards, we do in effect annex two cyphers to it, or multiply it by an *hundred*. And this we ought certainly to do; becauſe, having conſidered the multiplying figure as denoting only ſimple units, when it really expreſſed ſo many hundreds, the firſt operation gives no more than the hundredth part of the true product. The caſe is the ſame in multiplying by the fourth or fifth figures, becauſe the products ſtill running backwards, we thereby in effect annex as many cyphers to them as brings them up ſeverally to their reſpective adequate value. By this means it happens, that though the figures of the multiplier in every advance denote ſtill higher and higher combinations, yet we all along proceed with them as ſimple digits; the diſpoſition of the ſeveral products in order to addition making up for all the deficiencies that ariſe from this way of conſidering them. When in this method of procedure we have obtained the product of the multiplicand into all the different parts of the multiplier, by adding theſe products together, we obtain alſo the total product of the two numbers; for ſince the whole is equal to all its parts, nothing is more evident than that the product of any one number into another, muſt be equal to its product into all the parts of that other: and therefore the ſeveral partial products united into one ſum, cannot but truly repreſent the real product ſought.

Arithmetical operations, by being carried on in a progreſſive method, rendered eaſy and intelligible.

XV. Thus we ſee, that in queſtions of multiplication, though the whole proceſs is ſometimes ſufficiently long and tedious, yet the ſeveral ſteps by which it is carried on are all very level to the powers of the underſtanding; for from the account given above, it appears that nothing more is required in any of them than barely to multiply one digit by another. But now this eaſy rule of operation is wholly derived from the beforementioned addreſs in claſſing our perceptions; for to this it is owing that the numbers under conſideration are diſtinguiſhed into parts, and that the ſeveral parts are alſo clearly repreſented to the mind in the very form of notation. Now as theſe parts have an invariable relation one to another, and advance in their value by an uniform law of progreſſion, the underſtanding by means of ſuch a link can eaſily hold them together, and carry its views from ſtage to ſtage without perplexity or confuſion. Hence it happens, that however large and mighty the numbers are, ſo as far to exceed the immediate graſp of the mind, yet by running gradually through the ſeveral combinations of which they are made up, we at length comprehend them in their full extent. And becauſe it would be impoſſible for the underſtanding to multiply very large numbers one into another, by a ſimple effort of thought, therefore here alſo it conſiders the parts ſeparately, and, taking them in an orderly ſeries, advances by a variety of ſucceſſive ſteps. It is true indeed in the progreſs of the operation, the ſeveral figures riſe in their value: but this conſideration enters not the work itſelf; for there, as we have already ſeen, though the characters are taken as denoting only ſimple units, yet the order and diſpoſition of the partial products exhibits each according to its real amount. Hence, in every ſtep, we have only to multiply one digit by another, which, as it is attended with ſcarce any difficulty, the whole proceſs is carried on with wondrous diſpatch: and thus by a ſeries of eaſy operations, we at length riſe to diſcoveries, which in any other method of procedure, would have been found altogether beyond the reach of the mind.

The art of claſſing our perceptions the great mean and inſtrument of invention.

XVI. Since therefore by a due and orderly diſpoſition of our ideas we can bring the moſt wide and extended objects upon a level with the powers of the underſtanding; and ſince by this alſo we abridge the fatigue and labour of the mind, and enable it to carry on its reſearches in a progreſſive method, without which contrivance almoſt all the more remote and diſtant truths of the ſciences muſt have lain forever hid from our knowledge, I think we may venture to affirm, that the art of regulating and claſſing our perceptions is the great mean and inſtrument of invention. It is for this reaſon that I have endeavoured in ſo particular a manner to illuſtrate it from examples in numbers; becauſe we have here not only a perfect model of the art itſelf, but ſee alſo in the cleareſt manner what helps it furniſhes towards a ready comprehenſion of objects, and a maſterly inveſtigation of truth. Nor let any one find fault, as if we had inſiſted rather too long upon matters that are obvious and known to all; for I am apt to think that, though very few are ſtrangers to the received method of notation, and the common rules of operation in arithmetic,—yet it is not every one that ſets himſelf to conſider the addreſs and ſagacity that may be ſeen in the contrivance of them, or to unravel thoſe principles of inveſtigation which we have here ſo clearly deduced from them: and this I take to be the reaſon that we ſometimes meet with inſtances of men, who tho' thoroughly verſed in the art of invention, with regard to ſome particular branches of knowledge, yet, if taken out of their uſual track, find themſelves immediately at a ſtand, as if wholly bereft of genius and penetration. With ſuch men invention is a mere habit, carried on in a manner purely mechanical, without any knowledge of the grounds and reaſons upon which the ſeveral rules of inveſtigation are founded. Hence they are unfurniſhed with thoſe general obſervations which may be alike uſefully applied in all ſciences, with only ſome little neceſſary variations, ſuited to the nature of the ſubject we are upon. And indeed I know of no ſurer way to arrive at a fruitful and ready invention, than by attending carefully to the procedure of our own minds in the exerciſe of this diſtinguiſhed faculty; becauſe, from the particular rules relating to any one branch, we are often enabled to derive ſuch general remarks as tend to lay open the very foundation and principles of the art itſelf.

The manner of proceeding in the reſolution of algebraic queſtions.

XVII. If now we turn our thoughts from *arithmetic* to *algebra*, here alſo we ſhall find, that the great art of invention lies in ſo regulating and diſpoſing our notices of things, that we may be enabled to proceed gradually in the ſearch of truth. For it is the principal aim of this ſcience, by exhibiting the ſeveral relations of things in a kind of ſymbolical language, ſo to repreſent them to the imagination, as that we may carry our attention from one to another in any order we pleaſe. Hence, however numerous thoſe relations are, yet by taking only ſuch a number of them into conſideration at once as is ſuited to the reach and capacity of the underſtanding, we avoid perplexity and confuſion in our reſearches, and never put our faculties too much upon the ſtretch, ſo as to loſe ourſelves amidſt the multiplicity of our own thoughts. As therefore in *arithmetic*, we riſe to a juſt conception of the greateſt numbers, by conſidering them as made up of various progreſſive combinations, ſo likewiſe in *algebra*, thoſe manifold relations that often intervene between known and unknown quantities, are clearly repreſented to the mind, by throwing them into a ſeries of diſtinct equations. And as the moſt difficult queſtions relating to numbers are managed with eaſe, becauſe we can take the parts or figures ſeparately, and proceed with them one after another, ſo alſo the moſt intricate problems of algebra are in like manner readily unfolded, by examining the ſeveral equations apart, and unravelling them according to certain eſtabliſhed rules of operation. And here it is well worth our notice, that in very complicated problems, producing a great number of different equations, it for the moſt part ſo happens, that every one of them includes a variety of unknown quantities. When therefore we come to ſolve them ſeparately, as it would too much diſtract and entangle the mind to engage in the purſuit of ſo many different objects at once, our firſt buſineſs is, by artfully coupling the ſeveral equations together, or by the various ways of multiplication, ſubſtraction, addition, and ſubſtitution, to derive others from them more ſimple, until at length by ſuch a gradual proceſs we arrive at ſome new equation, with only one unknown quantity. This done, we ſet ourſelves to conſider the equation laſt found, and having now to do with an object ſuited to the ſtrength and capacity of the mind, eaſily by the eſtabliſhed rules of the art, diſcover the quantity ſought. In this manner we proceed with all the ſeveral unknown quantities, one after another, and having, by a ſeries of diſtinct operations traced them ſeparately, the queſtion is thereby completely reſolved.

Of thoſe other artifices which may be conſidered as ſubſidiary helps to invention.

XVIII. Hence it appears, that the buſineſs of invention, as practiſed in algebra, depends entirely upon the art of abridging our thoughts, reducing the number of particulars taken under conſideration at once to the feweſt poſſible, and eſtabliſhing that progreſſive method of inveſtigation which we have already ſo fully explained from examples in arithmetic. I might eaſily ſhew that the ſame obſervation holds equally in other ſciences; but having already exceeded the bounds I at firſt preſcribed to myſelf in this chapter, ſhall only add, that beſides the grand inſtruments of knowledge already mentioned, there are innumerable other artifices ariſing out of the particular nature of the ſubject we are upon, and which may be conſidered as ſubſidiary helps to invention. Thus, in geometry, many demonſtrations of problems and theorems are wholly derived from the conſtruction of the figure made uſe of, and the drawing of lines from one point to another. In like manner in algebra, the deviſing of proper equations from the conditions of the queſtion propoſed, and contriving neat expreſſions for the unknown quantities, contribute not a little to the eaſy ſolution of problems. And when we have even carried on the inveſtigation to ſome ſingle equation with only one unknown quantity; as that unknown quantity may be variouſly perplexed and entangled with others that are known, ſo as to require a multiplicity of different operations before it can be diſengaged, which often involves us in long and intricate calculations, and brings ſurds and irrational quantities in our way,—algebraiſts, to prevent in ſome meaſure theſe inconveniences, and ſhorten as much as poſſible the proceſs, have fallen upon ſeveral methods of ſubſtitution, which are of great ſervice in very complicated queſtions. But theſe and ſuch like artifices of invention cannot be explained at length in this ſhort eſſay; it is enough to have given the reader a hint of them, and put him in the way of unravelling them himſelf, when he comes to apply his thoughts to thoſe particular branches of knowledge where they are ſeverally made uſe of.

Of the great advantages ariſing from a happy notation or expreſſion of our thoughts.

XIX. There is one thing however, that in a particular manner deſerves to be taken notice of before we diſmiſs this ſubject; and that is, the great advantages that may redound to ſcience by a happy notation or expreſſion of our thoughts. It is owing entirely to this, and the method of denoting the ſeveral combinations of numbers by figures ſtanding in different places, that the moſt complicated operations in arithmetic are managed with ſo much eaſe and diſpatch. Nor is it leſs apparent that the diſcoveries made by algebra are wholly to be imputed to that ſymbolical language made uſe of in it; for by this means we are enabled to repreſent the relations of things in the form of equations, and by variouſly proceeding with theſe equations, to trace out ſtep by ſtep the ſeveral particulars we are in queſt of. Add to all this, that by ſuch a notation, the eyes and imagination are alſo made ſubſervient to the diſcovery of truth; for the thoughts of the mind riſe up and diſappear, according as we ſet ourſelves to call them into view; and therefore, without any particular method of fixing and aſcertaining them as they occur, the retrieving them again when out of ſight, would often be no leſs painful than the very firſt exerciſe of deducing them one from another. When therefore in the purſuit of truth we carry our attention forward from one part of the inveſtigation to another, as nevertheleſs we have frequent occaſion to look back upon the diſcoveries already paſſed thro', could theſe be no otherwiſe brought into view than by the ſame courſe of thinking in which they were firſt traced, ſo many different attentions at once muſt needs greatly diſtract the mind, and be attended with infinite trouble and fatigue. But now, the method of fixing and aſcertaining our thoughts by a happy and well-choſen notation, entirely removes all theſe obſtacles. For thus, when we have occaſion to run to any former diſcoveries, as care is taken all along to delineate them in proper characters, we need only caſt our eye upon that part of the proceſs where they ſtand expreſſed, which will lay them at once open to the mind in their true and genuine form. By this means we can at any time take a quick and ready ſurvey of our progreſs, and running over the ſeveral concluſions already gained, ſee more diſtinctly what helps they furniſh towards the obtaining of thoſe others we are ſtill in purſuit of. Nay, further, as the amount of every ſtep of the inveſtigation lies fairly before us, by comparing them variouſly among themſelves, and adjuſting them one to another, we come at length to diſcern the reſult of the whole, and are enabled to form our ſeveral diſcoveries into an uniform and well-connected ſyſtem of truths, which is the great end and aim of all our enquiries.

Recapitulation.

XX. Upon the whole then it appears, that in order to proceed ſucceſsfully in the exerciſe of invention, we muſt endeavour as much as poſſible to enlarge the capacity of the mind, by accuſtoming it to wide and comprehenſive views of things;

that we muſt habituate ourſelves to a ſtrong and unſhaken attention, which carefully diſtinguiſhes all the circumſtances that come in our way, and lets nothing material ſlip its notice: in fine, that we muſt furniſh ourſelves with an ample variety of intermediate ideas, and be much in the exerciſe of ſingling them out and applying them for the diſcovery of truth. Theſe preparatory qualifications obtained, what depends upon art lies chiefly in the manner of combining our perceptions, and claſſing them together with addreſs, ſo as to eſtabliſh a progreſſive method of inveſtigation. And here it is of great importance to contrive a proper notation or expreſſion of our thoughts, ſuch as may exhibit them according to their real appearance in the mind, and diſtinctly repreſent their ſeveral diviſions, claſſes, and relations. This is clearly ſeen in the manner of computing by figures in arithmetic, but more particularly in that ſymbolical language, which hath been hitherto ſo ſucceſsfully applied in unravelling of algebraical problems. Thus furniſhed, we may at any time ſet about the inveſtigation of truth; and if we take care to note down the ſeveral ſteps of the proceſs as the mind advances from one diſcovery to another, ſuch an arrangement or diſpoſition of our thoughts conſtitutes what is called the *Method of Invention*; for thus it is plain that we follow the natural procedure of the underſtanding, and make the truths we have unravelled to ſucceed one another, according to the order in which they preſent themſelves to the mind, while employed in tracing and finding them out. And here again it well deſerves our notice, that as by this means the whole inveſtigation lies diſtinctly before us, ſo by comparing the ſeveral ſteps of it among themſelves, and obſerving the relation they bear one to another, we are enabled to form our diſcoveries into a regular ſyſtem of knowledge, where the truths advanced are duly linked together, and deduced in an orderly ſeries from firſt principles. This other manner of combining our thoughts is diſtinguiſhed by the name of the *method of ſcience*; which therefore now offers itſelf to be explained, and is accordingly the ſubject of the enſuing chapter.

CHAP. II.

Of the Method of Science.

Knowledge as derived from the contemplation of our ideas, of a neceſſary and unchangeable nature.

I. IN order to give the juſter idea of the rules peculiar to this ſpecies of method, and eſtabliſh them upon their proper foundation, it will be neceſſary to begin with ſettling the meaning of the word *ſci-*

ence, and ſhewing to what parts of human knowledge that term may be moſt fitly applied. We have already obſerved, in the firſt chapter of the ſecond book, that there are three ſeveral ways of coming at the knowledge of truth. Firſt, By contemplating the ideas in our own minds. Secondly, By the information of the ſenſes. Thirdly, By the teſtimony of others. When we ſet ourſelves to conſider the ideas in our own minds, we variouſly compare them together, in order to judge of their agreement or diſagreement. Now as all the truths deduced in this way flow from certain connections and relations diſcerned between the ideas themſelves; and as when the ſame ideas are brought into compariſon, the ſame relations muſt ever and invariably ſubſiſt between them, hence it is plain that the knowledge acquired by the contemplation of our ideas is of a neceſſary and unchangeable nature. But farther: As theſe relations between our ideas are not only ſuppoſed to be real in themſelves, but alſo to be ſeen and diſcerned by the mind; and as when we clearly perceive a connection or repugnance between any two ideas, we cannot avoid judging them to agree or diſagree accordingly, it evidently follows that our knowledge of this kind is attended with abſolute certainty and conviction, inſomuch that it is impoſſible for us to withhold our aſſent, or entertain any doubt as to the reality of truths ſo offered to the underſtanding. The relation of equality between the whole and all its parts, is apparent to every one who has formed to himſelf a diſtinct notion of what the words *whole* and *part* ſtand for. No man, therefore, who has theſe two ideas in his mind, can poſſibly doubt of the truth of this propoſition, *that the whole is equal to all its parts*; for this would be only endeavouring to perſuade himſelf, that that was not, which he plainly and unavoidably perceives to be. So that in all caſes where we diſcern a relation between any of our ideas, whether immediately by comparing them one with another, or by means of intermediate ideas, that lay it open diſtinctly to the underſtanding, the knowledge thence ariſing is certain and infallible. I ſay infallible, becauſe we not only perceive and own the truth of propoſitions ſo offered to the mind, but having at the ſame time a clear view of the ground on which our aſſent reſts, are entirely ſatisfied within ourſelves that we cannot poſſibly be deceived in this perception.

As flowing from the information of the ſenſes, begets undoubted aſſurance, but excludes not all poſſibility of being deceived.

II. This ſecond way of coming at knowledge is by the means of the ſenſes. From them we receive information of the exiſtence of objects without us, of the union and conjunction of different qualities in the ſame ſubject, and of the operation of bodies one upon another. Thus our eyes tell us, that there is in the univerſe ſuch a body as we call the ſun; our ſight and touch, that light and heat, or at leaſt the power of exciting thoſe perceptions in us, co-exiſt in that body; and laſtly, by the ſame ſight we alſo learn, that fire has the power of diſſolving metals, or of reducing wood to charcoal and aſhes. But now, with regard to this kind of knowledge, we are to obſerve, that tho' when the organs of the body are rightly diſpoſed and operate in a natural way, we never doubt the teſtimony of our ſenſes, but form moſt of the ſchemes of life upon their information; yet are not the truths of this claſs attended with that abſolute and infallible aſſurance which belongs to thoſe derived from the contemplation of our own ideas. We find that the ſenſes frequently repreſent objects as really exiſting, which yet have no being but in our own imaginations; as in dreams, phrenzies, and the deliriums of a fever. A diſorder too in the organs, makes us often aſcribe qualities to bodies entirely different from thoſe they appear to poſſeſs at other times. Thus, a man in the jaundice ſhall fancy every object preſented to him yellow; and in bodily diſtempers, where the taſte is greatly vitiated, what naturally produces the idea of ſweetneſs, is ſometimes attended with a quite contrary ſenſation. It is true, theſe irregularities neither ought, nor indeed do they with conſiderate men in any ways tend to diſcredit the teſtimony of experience. He that, awake, in his ſenſes, and ſatisfied that his organs operated duly, ſhould take it into his head to doubt whether fire would burn, or arſenic poiſon him, and therefore raſhly venture upon theſe objects, would ſoon be convinced of his error, in a way not much to his liking. As nevertheleſs the ſenſes do ſometimes impoſe upon us, there is no abſolute and infallible ſecurity that they may not at others; therefore the aſſurance they produce, though reaſonable, ſatisfying, and ſufficiently well founded to determine us in the ſeveral actions and occurrences of life, is yet of ſuch a nature as not neceſſarily to exclude all poſſibility of being deceived. Hence ſome men go ſo far as to maintain, that we ought to diſtruſt our ſenſes altogether: nay, whole ſects among the antients, becauſe of this bare poſſibility, which really extends no farther than to matters of *experience* and *teſtimony*, yet eſtabliſhed it as a principle, that we ought to doubt of every thing. Nor are there wanting philoſophers among the moderns who, upon the ſame grounds, deny the exiſtence of bodies, and aſcribe the perceptions excited in us, not to the action of external matter, but to certain eſtabliſhed laws in nature, which operate upon us in ſuch manner as to produce all thoſe ſeveral effects that ſeem to flow from the real preſence of objects variouſly affecting our perception. It is not my deſign here to enter into a particular diſcuſſion of theſe matters: all I aim at is to ſhew, that the teſtimony of the ſenſes, though ſufficient to convince ſober and reaſonable men, yet does not ſo unavoidably extort our aſſent as to leave no room for ſuſpicion or diſtruſt.

As founded upon teſtimony, is of a ſtill more uncertain nature, though in many caſes embraced without wavering or diſtruſt.

III. The third and laſt way of coming at truth is, by the report and teſtimony of others. This regards chiefly paſt facts and tranſactions, which having no longer any exiſtence, cannot be brought within the preſent ſphere of our obſervation; for as theſe could never have fallen under our cognizance but by the relations of ſuch as had ſufficient opportunities of being informed, it is hence apparent, that all our knowledge of this kind is wholly founded upon the conveyance of teſtimony. But now, although this in many caſes is a ſufficient ground of aſſent, ſo as to produce a ready belief in the mind, yet is it liable to ſtill greater objections than even the reports of experience. Our ſenſes, it is true, on ſome occaſions deceive us; and therefore they may poſſibly on others. But this bare poſſibility creates little or no diſtruſt, becauſe there are fixed rules of judging when they operate acccording to nature, and when they are prevented or given up to caprice. It is otherwiſe in matters of mere human teſtimony; for there, beſides the ſuppoſition that the perſons themſelves may have been deceived, there is a further poſſibility that they may have conſpired to impoſe upon others by a falſe relation. This conſideration has the greater weight, as we frequently meet with ſuch inſtances of diſingenuity among men, and know it to be their intereſt in ſome particular caſes, to diſſemble and miſrepreſent the truth. It would nevertheleſs be the height of folly to reject all human teſtimony without diſtinction, becauſe of this bare poſſibility. Who can doubt whether there ever were in the world ſuch conquerors as *Alexander* and *Julius Cæſar?* There is no abſolute contradiction indeed in ſuppoſing that hiſtorians may have conſpired to deceive us. But ſuch an univerſal concurrence to a falſehood, without one contradicting voice, is ſo extremely improbable, and ſo very unlike what uſually happens in the world, that a wiſe man could as ſoon perſuade himſelf to believe the groſſeſt abſurdity, as to admit of a ſuppoſition ſo remote from every appearance of truth. Hence the facts of hiſtory, when well atteſted, are readily embraced by the mind; and though the evidence attending them be not ſuch as produces a neceſſary and infallible aſſurance, it is yet abundantly ſufficient to juſtify our belief, and leave thoſe without excuſe who, upon the bare ground of poſſibility, are for rejecting entirely the conveyance of teſtimony.

Science belongs entirely to that branch of knowledge which is derived from the contemplation of our ideas.

IV. Upon the whole then, it appears that abſolute certainty, ſuch as is attended with unavoidable aſſent, and excludes all poſſibility of being deceived, is to be found only in the contemplation of our own ideas. In matters of experience and teſtimony, men we ſee may frame pretences for ſuſpicion and diſtruſt; but in that part of knowledge which regards the relations of our ideas, none ſuch can have place; for as all theſe ſeveral relations are either immediately diſcerned by the mind, or traced by means of immediate ideas, where ſelf-evidence is ſuppoſed to accompany every ſtep of the procedure, it is abſolutely impoſſible for a man to perſuade himſelf that that is not, which he plainly and neceſſarily perceives to be. Now it is to knowledge attended with this laſt kind of evidence alone, that, in ſtrictneſs and propriety of ſpeech, we attribute the name of *ſcience*; for *ſcience* implies perception and diſcernment, what we ourſelves ſee and cannot avoid ſeeing; and therefore has place only in matters of abſolute certainty, where the truths advanced are either intuitive propoſitions, or deduced from them in a way of ſtrict demonſtration. And as this kind of certainty is nowhere to be found but in inveſtigating the relations of our ideas, hence it is plain that *ſcience*, properly ſpeaking, regards wholly the firſt branch of human knowledge; that which we have ſaid is derived from a contemplation of the ideas in our own minds.

Our knowledge of the real exiſtence of objects not intuitive.

V. But here I expect it will be aſked, if *ſcience* and *demonſtration* belong only to the conſideration of our own ideas, what kind of knowledge it is that we have relating to bodies, their powers, properties, and operations one upon another? To this I anſwer, that we have already diſtinguiſhed it by the name of *natural* or *experimental*. But that we may ſee more diſtinctly wherein the difference between *ſcientifical* and *natural* knowledge lies, it may not be improper to add the following obſervations:—When we caſt our eyes towards the ſun, we immediately conclude that there exiſts an object without us, correſponding to the idea in our minds. We are however to take notice, that this concluſion does not ariſe from any neceſſary and unavoidable connection diſcerned between the appearance of the idea in the mind and the real exiſtence of the object without us. We all know by experience, that ideas may be excited, and that too by a ſeeming operation of objects upon our ſenſes, when there are in fact no ſuch objects exiſting; as in dreams, and the deliriums of a fever. Upon what then is the beforementioned concluſion properly grounded? Why evidently upon this, that as we are ſatisfied our organs operate duly, and know that every effect muſt have a cauſe, nothing is more natural than to ſuppoſe, that where an idea is excited in the mind, ſome object exiſts correſponding to the idea, which is the cauſe of that appearance. But as this concluſion, by what we have ſeen, is not neceſſary and unavoidable, hence there is no *intuition* in the caſe, but merely a probable conjecture, or reaſonable preſumption, grounded upon an intuitive truth.

Abſolute certainty in natural knowledge confined to what falls under our immediate notice.

VI. Again: When a piece of gold is diſſolved in *aqua regia*, we ſee indeed and own the effect produced, but cannot be ſaid in ſtrictneſs and propriety of ſpeech, to have any perception or diſcernment of it. The reaſon is, becauſe being unacquainted with the intimate nature both of *aqua regia* and gold, we cannot, from the ideas of them in our minds, deduce why the one operates upon the other in that particular manner. Hence it is that our knowledge of the facts and operations of nature extends not with certainty beyond the preſent inſtance, or what falls under our immediate notice; ſo that in all our reſearches relating to them, we muſt proceed in the way of trial and experiment, there being here no general or univerſal truths whereon to found *ſcientifical* deductions. Becauſe the ſolution of gold in *aqua regia* holds in one experiment, we cannot thence infallibly conclude that it will hold in another; for not knowing upon what it is, in either of theſe bodies, that the effect here mentioned depends, we have no abſolute certainty in any new experiment we propoſe to make, that the objects to be applied one to another have that preciſe texture and conſtitution from which this ſolution reſults. Chemiſts know by experience, that bodies which go by the ſame name, and have the ſame outward appearance, are not always however exactly alike in their powers and operations. In vain do they often ſearch for thoſe properties in one piece of *antimony*, which on former occaſions they may have found in another; and by this means, to their no ſmall mortification, find themſelves frequently diſappointed in very coſtly and promiſing experiments. Nor have we any expreſs and poſitive aſſurance that the very bodies with which we have formerly made experiments continue ſo exactly the ſame, as to afford the like appearances in any ſucceeding trial. A thouſand changes happen every moment in the natural world, without our having the leaſt knowledge or perception of them. An alteration in our atmoſphere, the approach or receſs of the ſun, his declination toward the north or ſouth, not only vary the outward face of things, but occaſion many changes in the human conſtitution itſelf, which we yet perceive not when they happen; nor ſhould ever be ſenſible of, but by the effects and conſequences reſulting from them. And whether alterations analogous to theſe may not ſometimes be produced in the frame and texture of many bodies that ſurround us, is what we cannot with certainty determine. Hence, from an experiment's ſucceeding in one inſtance, we cannot infallibly argue that it will ſucceed in another, even with the ſame body. The thing may indeed be probable, and that in the higheſt degree; but as there is ſtill a poſſibility that ſome change may have happened to the body, unknown to us, there can be no abſolute certainty in the caſe.

What kind of knowledge of body would deſerve the name of ſcience.

VII. Had we ſuch an intimate acquaintance with the ſtructure both of *aqua regia* and gold, as to be able thence to diſcern why the one ſo operates upon the other as to occaſion its diſſolution; inſomuch that from the ideas of them in our own minds we could clearly deduce that bodies of ſuch a make applied one to another, muſt neceſſarily produce the effect here mentioned,—our knowledge would then be *ſcientifical*, and ſtand upon the foundation either of *intuition* or *demonſtration*, according as the perception was immediate, or attained by means of intervening ideas. In this caſe therefore, having two ſtandard ideas in our minds, whoſe relations we perfectly well know, wherever we found objects conformable to theſe ideas, we could then pronounce with certainty that the application of them one to another would be attended with the above effect; becauſe whatever is true in idea is unavoidably ſo alſo in reality of things, where things exiſt anſwerable to theſe ideas. If it be true in idea that a parallelogram is the double of a triangle ſtanding upon the ſame baſe, and between the ſame parallels, the ſame will be true of every real triangle and parallelogram that exiſt with the conditions here mentioned. We are likewiſe to obſerve, that the changes to which bodies are daily liable, could produce no confuſion or perplexity in natural knowledge, did it ſtand upon the foundation here mentioned; for in ſuch a caſe, the powers and properties of objects being deduced from the ideas of them in our own minds, would no otherwiſe be applied to things really exiſting, than as theſe things are found perfectly conformable to our ideas. When therefore an alteration happened in any body, as it would by this means differ from that ſtandard idea whence its former properties were ſeen to flow, we muſt of courſe be ſenſible that ſome ſuitable change would follow in the properties themſelves, and that its powers and operations in regard of other bodies, would not be in all reſpects the ſame.

Experience the only foundation of natural knowledge.

VIII. But what is ſtill more remarkable, we ſhould upon this ſuppoſition be able to determine the mutual action and influence of bodies, without having recourſe to trial or experiment. Had we, for inſtance, a perfect knowledge of the intimate nature and compoſition of an animal body, and of that particular poiſon that is infuſed into it by the bite of a viper, ſo as clearly and diſtinctly to diſcern how they are adapted one to another, we might thence ſcientifically deduce, without the help of experiments, that the bite of a viper would ſo unhinge the human fabric, and produce ſuch ferments and combuſtions in it, as muſt neceſſarily be followed by a total extinction of all the vital functions, and leave that admirable machine a mere lifeleſs lump. But as ſuch perfect and adequate ideas of objects, and their mutual habitudes one to another, are plainly beyond the reach of our preſent faculties, it were vain for us to think of improving natural knowledge by abſtract reaſoning or ſcientifical deductions. Experience is here the true and proper foundation of our judgments; nor can we by any other means arrive at a diſcovery of the ſeveral powers and properties of bodies. How long might a man contemplate the nature of hemlock, examine the ſtructure of its parts in a microſcope, and torture and analyſe it by all the proceſſes of chemiſtry, before he could pronounce with certainty the effect it will have upon a human body? One ſingle experiment lays that open in an inſtant, which all the wit and invention of men would never of themſelves have been able to trace. The ſame holds in all the other parts of natural philoſophy. Our diſcoveries relating to electricity, the powers and properties of the loadſtone, the force of gunpowder, &c. were not gained by reaſoning, or the conſideration of our abſtract ideas, but by means of experiments made with the bodies themſelves. Hence it happened, that while the philoſophy of *Ariſtotle* prevailed in the ſchools, which dealt much in metaphyſical notions, occult qualities, ſympathies, antipathies, and ſuch like words without meaning, the knowledge of nature was at a ſtand; becauſe men pretended to argue abſtractedly about things of which they had no perfect and adequate ideas whereon to ground ſuch a method of reaſoning. But now in the preſent age, that we have returned to the way of trial and experiment, which is indeed the only true foundation of natural philoſophy, great advances have already been made; and the proſpect of ſtill greater lies before us.

Difference between ſcientifical and natural knowledge.

IX. And thus at length we may ſufficiently underſtand wherein the proper difference lies between ſcientifical and natural knowledge. In matters of ſcience we argue from the ideas in our own minds, and the connections and relations they have one to another. And as when theſe relations are ſet clearly and plainly before us, we cannot avoid perceiving and owning them, hence all the truths of this claſs produce abſolute certainty in the mind, and are attended with a neceſſary and unavoidable aſſent. It is otherwiſe in the caſe of natural knowledge: intuition and inward perception have here no place. We diſcern not the powers and properties of thoſe objects that ſurround us, by any views and compariſon of the ideas of them one with another, but merely by experience, and the impreſſions they make on the ſenſes. But now the reports of ſenſe happening in ſome inſtances to deceive us, we have no infallible aſſurance that they may not in others; which weakens not a little the evidence attending this kind of knowledge, and leaves room for ſuſpicion and diſtruſt. Nay, what is yet more conſiderable, as we have no perfect and adequate ideas of bodies repreſenting their inward conſtitution, or laying open the foundation upon which their qualities depend, we can form no univerſal propoſitions about them, applicable with certainty in all particular inſtances. Fire, we ſay, diſſolves metals. This, though expreſſed indefinitely, is however only a particular truth; nor can be extended with abſolute aſſurance beyond the ſeveral trials made. The reaſon is, that being ignorant of the inward frame and compoſition both of fire and metals, when objects are offered to us under that name, we have therefore no poſitive certainty that they are of the very make and texture requiſite to the ſucceſs of the experiment. The thing may indeed be probable in the higheſt degree, but for want of ſtandard and ſettled ideas, we can never arrive at a clear and abſolute perception in the caſe.

The manner of reaſoning in natural knowledge.

X. As nevertheleſs it is certain that many general concluſions in natural philoſophy are embraced without doubt or heſitation; nay, that we form moſt of the ſchemes and purſuits of life upon that foundation, it will naturally be aſked here, how come we by this aſſurance? I anſwer, not ſcientifically, and in the way of ſtrict demonſtration, but by analogy, and an induction of experiments. We diſtinguiſh fire, for inſtance, by ſuch of its qualities as lie more immediately open to the notice of the ſenſes; among which light and heat are the moſt conſiderable. Examining ſtill farther into its nature, we find it likewiſe poſſeſſed of the power of diſſolving metals. But this new property not having any neceſſary connection that we can trace with thoſe other qualities by which fire is diſtinguiſhed, we cannot therefore argue with certainty that wherever light and heat, &c. are, the power of diſſolving metals co-exiſts with them. 'Tis not till after we have tried the thing in a variety of experiments, and found it always to hold, that we begin to preſume there may be really ſome ſuch connection, tho' our views are too ſhort and imperfect to diſcover it. Hence we are led to frame a general concluſion, arguing from what has already happened, to what will happen again in the like caſes; inſomuch, that where we meet with all the other properties of fire in any body, we have not the leaſt doubt but that upon trial, the power above mentioned will be found to belong to it alſo. This is called reaſoning by *analogy*; and it is, as we ſee, founded entirely upon induction, and experiments made with particular objects: the more preciſe and accurate our ideas of theſe objects are, and the greater the variety of experiments upon which we build our reaſoning, the more certain and undoubted will the concluſions be. It is in this manner we arrive at all the general truths of natural knowledge; as that the bite of certain animals is mortal; that a needle touched by a loadſtone points to the north; that gravity belongs univerſally to all bodies; and innumerable others, which though not capable of ſtrict demonſtration, are nevertheleſs as readily embraced upon the foundation of analogy, as the moſt obvious and intuitive judgments; nay, and become fixed and ſteady principles of action in all the aims and purſuits of life.

How even ſcientifical reaſoning may be introduced into it.

XI. And here again it is particularly remarkable, that having aſcertained the general properties of things by analogy, if we proceed next to eſtabliſh theſe as *poſtulata* in philoſophy, we can upon this foundation build ſtrict and mathematical demonſtrations, and thereby introduce *ſcientifical* reaſoning into natural knowledge. In this manner Sir *Iſaac Newton*, having determined the laws of gravity by a variety of experiments, and laying it down as a principle, that it operates according to thoſe laws thro' the whole ſyſtem of nature, has thence in a way of ſtrict demonſtration, deduced the whole theory of the heavenly motions. For granting once this *poſtulatum*, that gravity belongs univerſally to all bodies, and that it acts according to their ſolid content, decreaſing with the diſtance in a given ratio, what Sir *Iſaac* has determined in regard to the planetary motions, follows from the bare conſideration of our own ideas; that is, neceſſarily and *ſcientifically*. Thus likewiſe in *optics*: if we lay it down as a principle, that light is propagated on all ſides in right lines, and that the rays of it are reflected and refracted according to certain fixed invariable laws, all which is known to be true by experience, we can upon this foundation eſtabliſh mathematically the theory of viſion. The ſame happens in *mechanics*, *hydroſtatics*, *pneumatics*, &c. where from *poſtulata* aſcertained by experience, the whole theory relating to theſe branches of knowledge follows in a way of ſtrict demonſtration. And this I take to be the reaſon why many parts of natural philoſophy are honoured with the name of *ſciences*. Not that they are ultimately founded upon intuition; but that the ſeveral principles peculiar to them being aſſumed upon the foundation of experience, the theory deduced from theſe principles is eſtabliſhed by *ſcientifical* reaſoning.

Yet ſtill experience is the ultimate ground of our aſſent.

XII. Could we indeed diſcern any neceſſary connection between gravity and the known eſſential qualities of matter, inſomuch that it was inſeparable from the very idea of it, the whole theory of the planetary motions would then be ſtrictly and properly *ſcientifical*; for ſeeing, from the notion of gravity, we can demonſtratively determine the laws that bodies will obſerve in their revolutions in any known circumſtances, if the circumſtances relating to any ſyſtem of bodies can be traced, and gravity is ſuppoſed eſſential to them, we can then, from the bare conſideration of our own ideas, deduce all their motions and phænomena. Now this is preciſely what Sir *Iſaac* has done in regard to our planetary ſyſtem. He has determined the circumſtances of the bodies that compoſe it, in reſpect of ſituation, diſtance, magnitude, &c. all which being ſuppoſed, if they are eſſentially actuated by gravity, their ſeveral revolutions and appearances muſt be equally eſſential. But as the principle of gravitation cannot be accounted for by the known qualities of matter, neither can this theory be immediately deduced from the idea of body; and therefore, tho' our reaſoning in this part of philoſophy be truly ſcientifical, yet as the principle upon which that reaſoning is grounded is derived from experience, the theory itſelf muſt needs ultimately reſt upon the ſame foundation. And thus even the doctrine of the planetary motions, though ſeemingly eſtabliſhed by mathematical reaſoning, falls yet, in ſtrictneſs and propriety of ſpeech, under the head of natural knowledge. For in this preciſely conſiſts the difference between *ſcience* and what we call the *philoſophy of nature*; that the one is grounded ultimately on *intuition*, the other on *experience*. As the obſervation here made holds alike in all the other branches of natural philoſophy, into which *ſcientifical* reaſoning has been introduced, it is hence apparent that they are not *ſciences*, in the ſtrict and proper ſenſe of the word, but only by a certain latitude of expreſſion common enough in all languages. What we have therefore ſaid above, relating to the impoſſibility of improving natural knowledge by ſcientifical deductions, is not contradicted by any thing advanced in this ſection. We there meant deductions grounded ultimately on intuition, and derived from a conſideration of the abſtract ideas of objects in our own minds; not ſuch as flow from *poſtulata* aſſumed upon the foundation of experience. For theſe laſt, as we have already obſerved, are not truly and properly ſcientifical, but have obtained that name merely on account of the way of reaſoning in which they are collected from the ſaid *poſtulata*.

The manner of reaſoning in hiſtorical knowledge.

XIII. If then abſolute and infallible certainty is not to be obtained in natural knowledge, much leſs can we expect it in hiſtorical; for here teſtimony is the only ground of aſſent; and therefore the poſſibility of our being deceived is ſtill greater than in the caſe of experience. Not only he who reports the fact may himſelf have formed a wrong judgment; but could we even get over this ſcruple, there is ſtill room to ſuſpect, that he may aim at impoſing upon us by a falſe narration. In this caſe therefore it is plain, there can be no intuition or inward perception of truth, no ſtrict and abſolute demonſtration, and conſequently no *ſcience*. There is however a way of reaſoning even here, that begets an entire acquieſcence, and leads us to embrace without wavering, the facts and reports of hiſtory. If, for inſtance, it appears that the hiſtorian was a man of veracity; if he was a competent judge of what he relates; if he had ſufficient opportunities of being informed; if the book that bears his name was really writ by him; if it had been handed down to us uncorrupted; in fine, if what he relates is probable in itſelf, falls in naturally with the other events of that age, and is atteſted by contemporary writers,—by theſe and ſuch like arguments, founded partly on criticiſm, partly on probable conjecture, we judge of paſt tranſactions; and though they are not capable of *ſcientifical* proof, yet in many caſes we arrive at an undoubted aſſurance of them; for as it is abſurd to demand mathematical demonſtration in matters of fact, becauſe they admit not of that kind of evidence, it is no leſs ſo to doubt of their reality, when they are proved by the beſt arguments their nature and quality will bear.

Scepticiſms neceſſarily excluded from matters of ſcience.

XIV. And thus we ſee, in the ſeveral diviſions of human knowledge, both what is the ground of judging, and the manner of reaſoning peculiar to each. In *ſcientifical* knowledge, which regards wholly the abſtract ideas of the mind, and thoſe relations and connections they have one with another, our judgments are grounded on *intuition*; and the manner of reaſoning is by *demonſtration*. In natural knowledge, reſpecting objects that exiſt without us, their powers, properties, and mutual operations, we judge on the foundation of *experience*, and reaſon by *induction* and *analogy*. Laſtly, In *hiſtorical knowledge*, which is chiefly converſant about paſt facts and tranſactions, *teſtimony* is the ground of judgment; and the way of reaſoning is by *criticiſm* and *probable conjecture*. And now I think we are able effectually to overthrow that abſurd kind of *ſcepticiſm* maintained by ſome of the antients, which brings all propoſitions upon a level, and repreſents them as equally uncertain. What gave the firſt riſe to this doctrine was, the caprice of certain philoſophers, who obſerving that the reports of ſenſe and teſtimony were in ſome inſtances deceitful, took thence occaſion to ſuppoſe that they might be ſo likewiſe in others, and thereupon eſtabliſhed it as a principle, that we ought to doubt of every thing. But even with reſpect to this doubting, we are to obſerve, that it can in fact extend no farther than to matters of *experience* and *teſtimony*, being totally and neceſſarily excluded from *ſcientifical* knowledge. When ideas make their appearance in the underſtanding, it is impoſſible for us to doubt of their being there: and when the relations of any of our ideas are clearly and diſtinctly diſcerned by the mind, either immediately, which is *intuition*, or by means of intervening ideas, which is *demonſtration*, it would be in vain for us to endeavour to perſuade ourſelves that *that* is not, which we plainly and unavoidably perceive to be. In this caſe therefore we cannot withhold our aſſent; truth forces its way over all oppoſition, and breaks in with ſo much light upon the mind, as to beget abſolute and infallible certainty.

And to be admitted with caution in matters of experience and teſtimony.

XV. Indeed, in natural and hiſtorical knowledge *ſcepticiſm* may have place, becauſe, as we have ſaid, there is a poſſibility of our being deceived; but then it is to be obſerved, that a bare poſſibility is a very weak ground whereon to bottom any philoſophical tenet. It is poſſible that *Great Britain* may be ſwallowed up by the ſea before to-morrow; but I believe no man is on this account inclined to think that it will be ſo. It is poſſible the whole human race may be extinguiſhed the next inſtant; yet this poſſibility creates no apprehenſion that the thing itſelf will really happen. In a word, we ought to judge of things by the proofs brought to ſupport them, not by bare abſtract poſſibilities; and when we have all the evidence they are capable of, that alone is ſufficient to convince, tho' perhaps the contrary cannot be ſhewn to imply a contradiction. Will any wiſe and conſiderate man doubt whether there be ſuch a place as *America*, becauſe we cannot prove by any neceſſary argument that it is abſolutely impoſſible all the relations concerning it ſhould be falſe? Strict and rigorous demonſtrations belong not to hiſtory, or the philoſophy of nature. The way of reaſoning in theſe branches of knowledge is by arguments drawn from experience and teſtimony: and when the truth of any propoſition is in this manner ſufficiently aſcertained, inſomuch that it appears with all the evidence it is capable of, and we have as great reaſon to believe that it is as we could poſſibly have, ſuppoſing it were, is not this upon the matter as ſatisfactory as a demonſtration? It muſt be owned indeed, there is no inward perception in the caſe, and therefore our aſſent cannot be ſaid to be neceſſary and unavoidable. Men may in theſe matters be *ſceptics* if they pleaſe; and if they are reſolved upon it, it is in vain to contend with obſtinacy and perverſeneſs. I cannot however but obſerve, that if they will really act up to their own principles, and treat all things in good earneſt as uncertain that admit not of ſtrict ſcientifical proof, their conduct muſt be the very madneſs of folly. No man can demonſtrate mathematically that poiſon has not been conveyed into his meat or drink. And if he will be ſo very cautious as not to taſte of either till he has reached this degree of certainty, I know no other remedy for him but that, in great gravity and wiſdom, he muſt die for fear of death. The truth of it is, the moſt zealous patrons of *ſcepticiſm*, after all their pretended doubts and ſcruples, find it yet convenient to behave in the ſeveral occurrences of life, as if they gave entire credit to the reports of ſenſe and teſtimony. They will no more venture upon a doſe of arſenic, or ruſh into the midſt of a glowing furnace, than if they verily believed death would be the conſequence. And though in this it muſt be owned they act diſcreetly, yet have we hence at the ſame time a very convincing argument of the abſurdity of thoſe notions they affect to entertain. In reality, can any thing be more ridiculous than to give into a ſcheme of thinking, which we find ourſelves neceſſitated to contradict in almoſt every occurrence of life? Opinions are not to be taken up out of caprice and fancy, but to ſerve as principles of action, and ſtanding rules of behaviour. When they anſwer not this main purpoſe, they are unavailing and fruitleſs; and an obſtinate adherence to them, in ſpite of the repeated admonitions of experience, juſtly deſerves to be branded for folly. We ſhall not therefore attempt to multiply arguments in a matter ſo obvious, it ſufficiently anſwering our preſent purpoſe to have ſhown, that doubting and uncertainty have no place in ſcientifical knowledge, and that even in matters of hiſtory and the facts of nature, an undiſtinguiſhing ſcepticiſm would be in the higheſt degree abſurd.

Science applicable to the concerns of human life.

XVI. But here perhaps it will be aſked, Why all this mighty noiſe about ſcience, when even according to the preſent account, it ſeems to be ſo very capricious and arbitrary a thing? For ſeeing it is wholly confined to the conſideration of our ideas, and we are at liberty to frame and combine thoſe ideas at pleaſure, this indeed opens a way to caſtles in the air of our own building, to many chimerical and fanciful ſyſtems, which men of warm and lively imaginations love to entertain themſelves with, but promiſes little of that knowledge which is worth a wiſe man's regard, and reſpects the great ends and purpoſes of life. Where is the advantage of barely contemplating our ideas, and tracing their ſeveral habitudes and relations, when it is in truth the reality of things that we are chiefly concerned to know, and thoſe reſpects they bear to us and one another? To this I anſwer, That if indeed our ideas noway regarded things themſelves, the knowledge acquired by their means would be of very little conſequence to human life. But ſince, as we have already obſerved, whatever is true in idea is unavoidably ſo alſo in the reality of things, where things exiſt anſwerable to theſe ideas, it is apparent, that by copying our ideas with care from the real objects of nature, and framing them in a conformity to thoſe conjunctures and circumſtances in which we are moſt likely to be concerned, a way is laid open to diſcoveries of the greateſt importance to mankind; for in this caſe, our ſeveral reaſonings and concluſions holding no leſs of the objects themſelves than of the ideas by which they are repreſented, may be therefore applied with certainty to theſe objects, as often as they fall under our notice. Thus mathematicians, having formed to themſelves ideas of cones, cylinders, ſpheres, priſms, &c. variouſly compare them together, examine their ſeveral properties, and lay down rules by which to calculate their relative bulk and dimenſions. But now as bodies anſwering in figure to theſe ideas come frequently under our obſervation, we have by this means an opportunity of applying mathematical knowledge to the common concerns of life; and by determining preciſely the quantity of extenſion in each body, can the better judge how far they will anſwer the purpoſes we have in view. The ſame thing happens in politics and morality. If we form to ourſelves ideas of ſuch communities, connections, actions, and conjunctures, as do or may ſubſiſt among mankind, all our reaſonings and concluſions will then reſpect real life, and ſerve as ſteady maxims of behaviour in the ſeveral circumſtances to which it is liable. It is not therefore enough that we ſet about the conſideration of any ideas at random; we muſt further take care that thoſe ideas truly regard things themſelves; for altho' knowledge is always certain when derived from the contemplation of our own ideas, yet it is then only uſeful and worthy our regard when it reſpects ideas taken from the real objects of nature, and ſtrictly related to the concerns of human life.

The method of ſcience begins with aſcertaining our ideas,

XVII. Having thus ſhown that there is ſuch a thing as *ſcience*, fixed and aſcertained the bounds of it, and explained its great uſe and importance in the affairs of mankind, it now remains that we lay down the rules of method peculiar to this branch of knowledge, and give ſome account of the manner in which that certainty and conviction which are inſeparable from it, may be moſt naturally and effectually produced. *Science*, as we have ſaid, regards wholly the abſtract ideas of the mind, and the relations they have one to another. The great ſecret therefore of attaining it, lies in ſo managing and conducting our thoughts, as that theſe ſeveral relations may be laid open to the view of the underſtanding, and become the neceſſary and unavoidable objects of our perception. In order to this we muſt make it our firſt care, diſtinctly to frame and ſettle the ideas about which our enquiries are to be employed. For as the relations ſubſiſting between them can no otherwiſe be diſcerned than by comparing them one with another; and as this compariſon neceſſarily ſuppoſes that the ideas themſelves are actually in the mind, and at that very time under our immediate inſpection, it plainly follows that all ſcience muſt begin with fixing and aſcertaining thoſe ideas. Now our ideas, as has been already obſerved in the firſt book, come all very naturally within the diviſion of *ſimple* and *complex*. *Simple* ideas are excited by actual impreſſions made upon the underſtanding; and as they exiſt under one uniform appearance, without variety or compoſition, are in no danger of being miſtaken or confounded one with another. It is otherwiſe in our *complex* conceptions; for theſe conſiſting of many ſimple ideas joined together, great care muſt be taken that we acquaint ourſelves with the true number combined, and the order and manner of their connection. By this means alone are theſe our moſt intricate notices kept diſtinct and invariable, inſomuch that in all our ſeveral views of them, they ever have the ſame appearance, and exhibit the ſame habitudes and reſpects. Here therefore, properly ſpeaking, the art of knowledge begins. For although we find it eaſy enough to bound and ſettle our ideas where they conſiſt of but few ſimple perceptions, yet when they grow to be very complicated, it often requires great addreſs and management to throw them into ſuch views as may prevent that confuſion which is apt to ariſe from the joint conſideration of a multiplicity of different objects. Hence that gradation in the compoſition of our ideas, which we have explained at large in the laſt chapter of the firſt book; for as they are by this means formed into different orders, and theſe orders ariſe continually one out of another, the underſtanding, by taking them in a juſt ſucceſſion, gradually mounts to the higheſt conceptions, and can at any time, with incredible eaſe and expedition bring all their parts diſtinctly into view. To know therefore the full value of this contrivance, we muſt attentively conſider the ſtrict connection that obtains between the ſeveral claſſes of our perceptions when diſpoſed in ſuch a ſeries. Every ſucceeding order is formed out of thoſe combinations that conſtitute the rank next below it: and as in advancing from one degree to another, we are always to proportion the number of notices united, to the ſtrength and capacity of the mind, it is apparent that by ſuch a procedure the ideas will be thoroughly aſcertained in every ſtep, and however large and bulky, lie yet fairly within our graſp. This obviouſly accounts for that wonderful clearneſs of apprehenſion which we often experience within ourſelves, even in regard to the moſt complicated conceptions; for though the multitude of parts in many caſes be great, I may ſay beyond belief, yet as they have been all previouſly formed into ſeparate claſſes, and the claſſes themſelves diſtinctly ſettled in the underſtanding, we find it eaſy, by ſuch a ſeries of ſteps, to riſe to any idea how complex ſoever, and with a ſingle glance of thought embrace it in its full extent.

and communicating them by means of definitions.

XVIII. But it is not enough that we barely form ideas in our own minds; we muſt alſo contrive a way to render them ſtable and permanent, that when they diſappear upon calling off our attention, we may know how to retrieve them again with certainty. This is beſt done by words and deſcriptions, which ſerve not only to ſubject them to our own review, but alſo to lay them open to the perception of others. And indeed as one of the main ends of reducing knowledge into the form of a ſcience is the eaſy and advantageous communication of truth, it ought always to be our firſt care when we ſet about unfolding our diſcoveries, to exhibit the ſeveral conceptions to which they relate, in a juſt and accurate ſeries of definitions; for till we have diſtinctly transferred our ideas into the underſtanding of thoſe to whom we addreſs ourſelves, and taught their connection with the appropriated ſounds, all our reaſonings will evidently be without effect. If men comprehend not the true import of our words, and are therefore led by them to bring wrong ideas into compariſon, they can never ſure ſee connections and habitudes that really ſubſiſt not. But if, on the contrary, the terms we uſe excite thoſe very perceptions in others which they denote in our own minds, then, as the ſeveral relations pointed out will lie fairly open to view, they muſt needs be diſcerned with great readineſs and eaſe, and ſtamp the character of certainty upon all our deductions.

The names of ſimple ideas conſtitute the original and elementary terms of language.

XIX. Thus we ſee that the *method of ſcience* begins with unfolding our ideas, and communicating them by means of definitions. And here it is of great importance to obſerve, that there muſt be in all languages certain original and elementary names, whence our deſcriptions take their firſt riſe, and beyond which we cannot trace the meaning and ſignification of ſounds; for ſince our very definitions are made up of words, if we ſuppoſe not ſuch primitive and fundamental terms, into which they all reſolve themſelves, and where they at laſt neceſſarily terminate, it is evident there would be no end of explaining. Now it is peculiar to our ſimple ideas, that they cannot be originally excited by words, but muſt always make their firſt entrance into the underſtanding by the actual operation of objects upon it. When therefore, in a ſeries of definitions, we arrive at the names of theſe ideas, 'tis plain we can puſh our deſcriptions no farther, but are neceſſitated to ſuppoſe, that the perceptions themſelves have already found admiſſion into the mind. If they have not, definitions avail nothing; nor can they any other way be impreſſed upon us than by betaking ourſelves to the ſeveral objects in which the power of producing them reſides. Hence it appears that the primary articles of ſpeech, into which the whole of language may be ultimately reſolved, are no other than the names of ſimple ideas: theſe we ſee admit not definitions. It is by experience and obſervation that we grow acquainted with their meaning, and furniſh ourſelves with the perceptions they ſerve to denote; for finding that thoſe in whoſe ſociety we live, make uſe of certain articulate ſounds to mark the various impreſſions of objects, we too annex theſe ſounds to the ſame impreſſions, and thus come to underſtand the import of their words. This way of knowledge takes place, in regard to all our ſimple ideas; but in many of thoſe that are complex, as they are the mere creatures of the underſtanding, and exiſt nowhere out of the mind, there are of courſe no real objects without us, whence they may be originally obtained. If therefore they could not be communicated by deſcriptions, we ſhould be left wholly without the means of transferring them into the minds of others. But happily it ſo falls out, that all complex conceptions whatſoever may be diſtinctly exhibited in definitions; for as they are no more than different combinations of ſim ple ideas, if theſe ſimple ideas have already got admiſſion into the underſtanding, and the names ſerving to expreſs them are known, it will be eaſy, by deſcribing the order, number, and peculiar connection of the notices combined, to raiſe in the mind of another the complex notion reſulting from them.

A knowledge of theſe previouſly ſuppoſed in handling any ſubject ſcientifically.

XX. Since then it is by ſimple ideas and their names that we unfold all the other conceptions of the mind, it manifeſtly follows, that in handling any ſubject *ſcientifically*, we muſt always ſuppoſe thoſe to whom we addreſs ourſelves previouſly furniſhed by experience with theſe firſt principles and elements of knowledge. Nor is this by any means an unreaſonable *poſtulatum*; becauſe the ſimple ideas that relate to the ſciences being few in number, and coming very often in our way, it is hardly poſſible we ſhould be unacquainted with them, or not have frequently heard their names in converſe with others. What principally demands our care is, to apply thoſe names aright, and according to the ſtrict uſe and propriety of the language in which we write. 'Tis ſeldom allowable to change the ſignification of words, eſpecially thoſe by which we denote ſimple ideas. If however ſuch a liberty ſhould at any time be found neceſſary, we may ſtill make ourſelves underſtood, by mentioning the idea under its common name, and ſignifying its connection with the newly-appropriated ſound. Indeed it ſometimes happens, that new and unuſual ideas of this kind are to be taken under conſideration, which we muſt therefore expreſs by terms of our own invention. In this caſe, as the ideas themſelves cannot be laid open by definitions, we refer to the ſeveral objects whence they may be obtained; which though it excites not the perceptions immediately, yet ſufficiently anſwers our purpoſe, by putting men in a way of being furniſhed with them at pleaſure.

The order and connection of our definitions.

XXI. This foundation being laid, the communication of our complex conceptions by definitions becomes both eaſy and certain; for ſince the ideas themſelves are formed into different orders, and theſe orders ariſe continually one out of another, nothing more is required on our part than to obſerve a like method and gradation in our deſcriptions. As therefore the firſt order of our compound notions is formed immediately from ſimple ideas, ſo the terms appropriated to this order muſt be defined by the names of theſe ideas. And as the ſecond and all the ſucceeding orders ariſe continually out of thoſe combinations that conſtitute the claſſes next below them, ſo the definitions correſponding to theſe different orders gradually take in the terms by which the ſeveral inferior diviſions are regularly and ſucceſſively expreſſed. In ſuch a ſeries of deſcriptions, it is evident at firſt ſight, that nothing can be obſcure and unintelligible; for as it begins with the names of ſimple ideas, whoſe meaning is ſuppoſed to be known; and as in every order of definitions ſuch terms only occur as have been previouſly explained in the preceding diſtributions, by advancing regularly from one to another, we gradually furniſh ourſelves with whatever is neceſſary towards a diſtinct conception of all that is laid before us. Nor is it a ſmall advantage attending this diſpoſition, that the ſeveral ideas deſcribed are hereby excited in the underſtanding, in the very order and manner in which they are framed by a mind advancing uniformly from ſimple to the moſt complicated notions. Hence we ſee diſtinctly the various dependence of things, and being put into that very train of thinking which leads directly to ſcience and certainty, are drawn inſenſibly to intereſt ourſelves in the purſuit; inſomuch that while in fact we do no more than follow a guide and conductor, we can yet hardly forbear fancying ourſelves engaged in the actual exerciſe of deducing one part of knowledge from another.

Of the immediate and intuitive relations between our ideas.

XXII. When we have thus fixed and aſcertained our ideas, and diſtinctly exhibited them in definitions, we then enter upon the important taſk of tracing their ſeveral habitudes and relations. In order to this we ſet about comparing them among themſelves, and viewing them in all the variety of lights by which we can hope to arrive at a diſcovery of their mutual agreement or diſagreement. And here it happens that ſome relations forwardly offer themſelves to the notice of the underſtanding, and become the neceſſary objects of perception, upon the very firſt application of our ideas one to another. Thoſe are therefore immediately owned, and conſtitute our *primary* and *intuitive* judgments, being attended with the higheſt degree of evidence, and producing abſolute certainty in the mind. But in many caſes, the connection or repugnance between our ideas, even when true and real, comes not yet within our immediate view, but requires ſearch and examination to diſcover it. On this occaſion we have recourſe to intermediate notices; and if by means of them we can muſter up a train of evident and known truths, which, diſpoſed in a regular ſeries of argumentation, lead at laſt to a concluſion expreſſing the relations we are in queſt of, the proof thence ariſing is called *demonſtration*. Now, as the conviction attending *demonſtration* is no leſs neceſſary and unavoidable than that which proceeds from *intuition*, it evidently follows, that whether the relations between our ideas are immediately diſcerned by the mind, or whether they are traced by means of intervening perceptions, in either caſe we arrive at *ſcience* and certainty. This however is particularly to be obſerved, that the more remote and diſtant reſpects being deduced from ſuch as are obvious and ſelf-evident, the propoſitions expreſſing theſe laſt demand our firſt notice, and ought to be previouſly eſtabliſhed before we enter upon higher inveſtigations. When therefore, in the *method of ſcience*, we have finiſhed the buſineſs of definitions, it muſt be our next care, diſtinctly to unfold in propoſitions thoſe immediate and intuitive relations which are neceſſarily ſeen and owned by the mind, upon the very firſt comparing of our ideas one with another. Theſe propoſitions have obtained the name of *firſt principles*, becauſe, occurring *firſt* in the order of knowledge, and being manifeſt of themſelves, they ſuppoſe not any *prior* truths in the mind whence they may be evidenced and explained. It is not needful to enlarge here upon the neceſſity of circumſpection and care in ſettling theſe primitive and fundamental perceptions; for ſince the whole ſuperſtructure of our knowledge reſts ultimately upon them, it is evident at firſt ſight that a miſtake in this caſe muſt at once overturn and annihilate all our future reaſonings. But having already explained the nature of theſe propoſitions in the ſecond book, unfolded the notion of ſelf-evidence, and taught the manner of diſtinguiſhing between the truths of this claſs and thoſe that are demonſtrable, we ſhall for the preſent wave any farther conſideration of this ſubject, referring the reader to what is there advanced, if he deſires fuller information.

Of the application of ſelf-evident truths in demonſtrating ſuch as are remote and diſtant.

XXIII. The firſt and more immediate relations of our ideas being thus pointed out, our next buſineſs is to inveſtigate ſuch as are remote and diſtant. And here it is that we have occaſion for intermediate notices, and a ſkilful application of intuitive truths. But though ſelf-evident propoſitions be the ultimate foundation of our reaſoning, we are not on that account to imagine that the art of improving knowledge lies in aſſembling at random a large and comprehenſive ſtock of theſe. Even *general principles*, conſidered by themſelves, avail but little towards the inveſtigation of truth : they are indeed uſeful as *media* of certainty, by preſerving the evidence of our reaſonings diſtinct, which never fail to convince, if, being purſued to their ſource, they are found to reſolve themſelves into and ultimately terminate in theſe principles. But when we ſet about the increaſe and enlargement of ſcience, far other helps are required; for here the whole ſecret conſiſts in deviſing and ſingling out ſuch intermediate ideas as, being compared with thoſe others whoſe relations we enquire after, may furniſh out a train of obvious and known truths, ſerving diſtinctly to inveſtigate the ſaid relations. *Euclid*, in the firſt book of the Elements, has demonſtrated, *that the three inward angles of a triangle taken together, are equal to two right angles*. The reaſoning by which he eſtabliſhes that propoſition, reſolves itſelf into this general principle: *Things equal to one and the ſame thing, are equal to one another*. Will any one however pretend to ſay, that a bare conſideration of the principle itſelf led him to that diſcovery? The mereſt novice in mathematics would upon this ſuppoſition be equally qualified for the buſineſs of invention, with one that had made the greateſt progreſs; inaſmuch as theſe general principles of the ſcience are commonly alike known to both. But the truth of it is, *Euclid* having found out angles, to which the three angles of a triangle, and two right angles, being compared, were found ſeverally equal, thereby aſcertained the propoſition in queſtion, by ſhewing it to terminate in the above axiom, tho' perhaps the axiom itſelf was never once thought of during the whole courſe of the inveſtigation.

Reaſoning, tho' reſolvable into general truths, reſts immediately upon particular ſelf-evident propoſitions.

XXIV. And here it may not be improper to obſerve, that tho' it be uſual in reaſoning, when we arrive at any particular ſelf-evident propoſition, to refer to the general axiom under which it is comprehended, yet is not this done out of abſolute neceſſity, or for the ſake of any additional confirmation. All intuitive truths, whether general or particular, ſtanding upon the ſame foundation of immediate perception, are neceſſarily embraced for their own ſake, and require no mutual illuſtration one from another. When therefore we have found that the three angles of a triangle, and two right angles, are ſeverally equal to the angles formed by one right line ſtanding upon another, we thence immediately diſcern their equality between themſelves, independent of the general axiom into which this truth may be reſolved. Nor do we in reality refer to that axiom by way of evidence and proof, but merely to ſhew the coincidence of the example under notice, with a previouſly eſtabliſhed general principle. The ſame thing happens in all other demonſtrations whatſoever, which terminating thus in particular ſelf-evident truths, are therefore of themſelves ſufficient to certainty, and acquire not any new force by being ultimately referred to general maxims. This I mention here, to obviate a common prejudice, whence many are led to imagine, that particular intuitive propoſitions derive their evidence from thoſe that are general, as being neceſſarily included in them. But ſince they both ſtand upon the ſame foundation of certainty, and are admitted in conſequence of immediate perception, they have therefore an equal claim to ſelf-evidence, and cannot be made plainer by any mutual appeal.

Particular ſelf-evident propoſitions ſo called here, in oppoſition to general principles.

XXV. As however it is uſual in the method of ſcience to lay down certain general principles by way of foundation for our future reaſonings, ſome perhaps will object that this ſeems to be a needleſs precaution, ſince demonſtrations may ſubſiſt without them, and commonly terminate in particular ſelf-evident truths, peculiarly connected with the ſubject under conſideration. In order therefore to give a diſtinct idea of the true deſign of this previous ſtep, we ſhall begin with obſerving, that by the particular propoſitions in which demonſtrations terminate, muſt not be underſtood ſuch as are ſo according to the ſtrict definition of the word, or in oppoſition to univerſals; but only confined and limited truths, when compared with others that are more general. Thus the propoſition, *Circles equal to one and the ſame* *circle, are equal between themſelves*, is in ſtrictneſs and propriety of ſpeech univerſal, becauſe the ſubject is taken in its full extent, and the predicate agrees to all the individuals comprehended under it. We here notwithſtanding conſider it as only a particular truth, becauſe it is of a very limited nature, when compared with the general axiom mentioned above; *Things equal to one and the ſame thing, are equal to one another*; for this not only extends to all the various ſpecies of figures, but takes in every object without exception, that comes under the denomination of Quantity.

General principles ſerve firſt to contract the bottom of our reaſoning.

XXVI. This point ſettled, it will eaſily appear that the method of premiſing general principles in the ſciences, anſwers theſe two great and valuable purpoſes: *firſt*, To contract the bottom of our reaſoning, and bring it within ſuch bounds as are ſufficiently accommodated to the capacity of the mind; for demonſtrations being carried on by means of intermediate ideas, which muſt always have ſome peculiar connection with the matter in hand, the particular ſelf-evident propoſitions in which they terminate, are almoſt as various as the ſubjects to which they relate. Thus in inveſtigating the equality of different objects, whether angles, triangles, circles, ſquares, &c. the intuitive truths on which the proofs reſt, always regard the particular ſpecies, and may be therefore multiplied *in infinitum*, as well as the ſpecies themſelves. But now it is remarkable that all theſe ſeveral truths, numerous as they may appear, are yet reducible to this one general principle already mentioned; *Things equal to one and the ſame thing, are equal to one another*. The ſame obſervation will be found to hold in other parts of human knowledge; inſomuch that though the particular truths on which we bottom our reaſonings are really innumerable, yet may they be all without exception reſolved into a very few general maxims, and thereby brought readily within the compaſs of the underſtanding. When therefore we begin with premiſing theſe general truths, and as we advance in ſcience, take care univerſally to reſolve our demonſtrations into them, this muſt needs add a wonderful clearneſs and perſpicuity to our reaſonings; and by eſtabliſhing them upon a foundation previouſly admitted, and of whoſe ſtrength and firmneſs we are abundantly ſatisfied, give them that irreſiſtible force and influence, which ſerves to produce abſolute certainty. Nor can we poſſibly imagine any thing more elegant and beautiful, than thus to behold knowledge riſing from a firm and fathomable root, bearing its head aloft, and ſpreading forth into innumerable branches of ſcience; which though variouſly implicated and entangled, and ſtretching to a vaſt extent, yet by their union in one common ſtock, derive thence ſo ſure and ſtable a ſupport, that all the aſſaults of cavil and ſcepticiſm are not able to deſtroy or looſen their connection.

Secondly, To aſcertain the juſtneſs of it with more eaſe, and leſs hazard of miſcarriage.

XXVII. But, *ſecondly*, Another purpoſe ſerved by general principles is, that they enable us with leſs fatigue and labour, and leſs hazard of miſcarriage, to ſatisfy ourſelves as to the juſtneſs of thoſe reaſonings by which ſcience is eſtabliſhed. For ſince demonſtrations, when purſued to their ſource, terminate always in particular intuitive truths, which are therefore the ultimate foundation of certainty, it greatly imports us to beware that we receive not any propoſitions under this name until we have diſtinctly ſettled them in our own minds, and attained a full and clear perception of that ſelf-evidence, on account of which they are admitted without proof. But now theſe propoſitions being many in number, and differing according to the nature of the ſubject about which our reſearches are employed, it muſt greatly perplex and retard our reaſonings, were we to check ourſelves every time they occur, in order to examine them by the rules of firſt principles. Nor is it a matter of ſlight conſideration, that in the heat and hurry of demonſtrating, while the mind is advancing eagerly from one diſcovery to another, we ſhould be often tempted to paſs them over haſtily, and without that attention their importance requires; which muſt expoſe us to many errors and miſtakes. Theſe inconveniences are effectually prevented by the method of premiſing general truths, becauſe, upon referring particular propoſitions t othem, as the connection is obvious at firſt ſight, and cannot poſſibly eſcape our notice, the evidence is diſcerned to be the very ſame with that of the principles to which they belong; and thus by a bare reference, without the trouble of particular experiments, the grounds of reaſoning are aſcertained, and our demonſtrations found ultimately to reſt on maxims previouſly eſtabliſhed.

Of the manner of linking propoſitions together, in order to the forming of legitimate demonſtrations.

XXVIII. Having explained the uſe of general principles, ſhewn them to be the great *media* of certainty, and found, that in order to enlarge the bounds of ſcience, we muſt have recourſe to intermediate ideas, as by means of them we are furniſhed with the ſeveral previous truths of which reaſoning conſiſts, it now remains that we enquire in what manner theſe truths are to be diſpoſed and linked together, towards the forming of juſt and legitimate *demonſtrations*. We have ſeen already in the preceding book, that *ſyllogiſms* drawn up according to the rules there eſtabliſhed, lead to a certain and infallible concluſion. If therefore evident and allowed truths are diſpoſed in a *ſyllogiſtic* order, ſo as to offer a regular concluſion, that concluſion is neceſſarily true and valid: and ſince in every genuine ſyllogiſm, if the premiſes are true, the concluſion muſt needs be true, it manifeſtly follows, that the concluſion already gained being now a known and eſtabliſhed truth, may be admitted as one of the premiſes of any ſucceeding ſyllogiſm, and thereby contribute towards the obtaining a new concluſion. In this manner may ſyllogiſms follow one another in train, and lead to a ſucceſſive diſcovery of truth, care being always taken that the premiſes in every ſtep are either ſelf-evident propoſitions, or concluſions previouſly eſtabliſhed. And indeed the whole art of *demonſtrating* lies in this due and orderly combination of our ſyllogiſms; for as by this means all the ſeveral premiſes made uſe of are manifeſtly true, all the ſeveral concluſions muſt be ſo too, and conſequently the very laſt concluſion of the ſeries, which is therefore ſaid to be *demonſtrated*. The ſame order is to be obſerved in the diſpoſition of the demonſtrations themſelves: that is, thoſe propoſitions are always firſt to be demonſtrated which furniſh principles of reaſoning in others; it being upon the certainty of the principles made uſe of, that the certainty of the truths deduced from them depends. And ſince even the different branches and diviſions of ſcience have a near connection among themſelves, inſomuch that the knowledge of one is often pre-ſuppoſed in another, great care muſt be taken to adjuſt the ſeveral parts with an eye to this dependence, that thoſe may always come firſt in order, whence the *poſtulata* of demonſtration in others are borrowed.

Why the method here explained is called the method of ſcience.

XXIX. In this way of putting together our thoughts, it is evident at firſt ſight, that however far we carry our reſearches, *ſcience* and *certainty* will ſtill attend us. But what is particularly elegant and happy in the method now explained, we hereby ſee knowledge riſing out of its firſt elements, and diſcern diſtinctly how thoſe elements are combined and interwoven, in order to the erecting a goodly ſtructure of truth. *Experience* furniſhes us with ſimple ideas and their names, which are the *primary* materials of thinking and communication. *Definitions* teach how to unite and bind theſe ideas together, ſo as to form them into complex notions of various orders and degrees. The *general principles* premiſed in ſcience exhibit to the underſtanding ſuch intuitive and fundamental truths to expreſs the immediate relations between our ideas, and conſtitute the ultimate ground of certainty. *Demonſtrations* link known and eſtabliſhed truths together in ſuch manner, that they neceſſarily lead to others which are unknown and remote. In fine, the duly adjuſting the ſeveral branches of ſcience, and the demonſtrations in every branch, lays knowledge ſo open to the mind, that we ſee the parts of it growing one out of another, and embrace them with full conviction and aſſurance. Thus we are gradually led from ſimple ideas, through all the windings and labyrinths of truth, until we at length reach the higheſt and moſt exalted diſcoveries of human reaſon. It is true, the method here laid down hath hitherto been obſerved ſtrictly only among mathematicians; and is therefore by many thought to be peculiar to number and magnitude. But it appears evidently from what we have ſaid above, that it may be equally applied in all ſuch other parts of knowledge as regard the abſtract ideas of the mind, and the relations ſubſiſting between them :—and ſince, wherever it is applied, it neceſſarily begets *ſcience and certainty*, we have hence choſen to denominate it the *method of ſcience*, the better to intimate its true nature and extent.

THE END.

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